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Electrical Contracting

The Magazine of

ELECTRICAL CONTRACTING

Lighting...

WARTIME AND POSTWAR

an editorial feature see pages 41 — 56

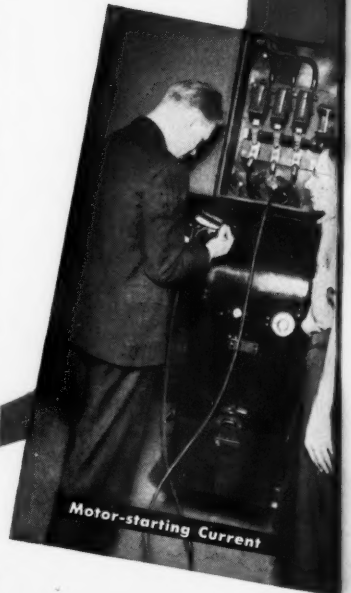
The RIGHT Instruments Help Get the Jump on TROUBLE

How Would
You Handle
these 3 Jobs?



- 1 **MOTOR LOAD** is being analyzed with a G-E portable inkless recorder. The test is made *without interrupting production*, simply by using a split-core current transformer (clamped around a lead in the control cabinet) connected to the recording ammeter.
- 2 **FEEDER CIRCUITS** are being checked with the G-E hook-on volt-ammeter. Both current and voltage are measured with just *one* instrument, simply by flicking the selector switch, first to AMPS and then to VOLTS.
- 3 **MOTOR-STARTING CURRENT** is being determined quickly by means of a G-E pointer-stop ammeter. An oscillograph could be used, but it is easier to use this instrument—particularly when there are a large number of motors to be checked.

These are typical examples of using the RIGHT instrument to get electric-circuit information in a hurry, without interrupting production. Have you the RIGHT ones for your preventive maintenance? This is particularly important if you have green hands in your maintenance department.



5 Instruments Will Do 90% of Most Testing Jobs

The G-E instruments shown below will handle most of your testing. Prices are for estimating only. For details, ask the nearest G-E office for the bulletins listed. If you need other instruments, let us know. *General Electric, Schenectady, N. Y.*

WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?



A-C HOOK-ON VOLT-AMMETER. The handiest of instruments for quick load checks—no cutting conductors or interrupting service. Measures volts also. Bulletin GEA-2950.

MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C). Accurate within $\frac{3}{4}$ of one per cent. Very portable—size only $2\frac{1}{2}$ by $4\frac{1}{2}$ by $6\frac{1}{2}$ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C). Accurate within one per cent. Slips easily into a coat pocket—size 2 by $3\frac{1}{2}$ by $5\frac{1}{2}$ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

INKLESS RECORDER, PORTABLE. An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-3187.

INK RECORDER, PORTABLE AND SWITCHBOARD. Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.

GENERAL ELECTRIC

502-42-0200

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Crows'nest
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for

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Company
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year, \$6.00
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"Murray"—the modern STANDARD in maintenance ladders!

These maintenance units make overhead servicing so fast and easy that light output is kept at maximum.

The chief advantage of these Murray Crows' nests is that they make overhead, out-of-the-way lights, unit heaters and sprinkler heads, easily accessible, without disturbing men, machines or production schedules in the slightest.

All the many important plants which have taken on Murray Crows' nests, wonder how any plant ever got along without them. Fill in the coupon and mail—we'll propose a unit suiting your particular needs. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Courtesy
"Happiness of Light"
General Electric Co.

Courtesy
"Happiness of Light"
General Electric Co.

Metropolitan Device Corp.
Brooklyn 16, N. Y.

Send data (without obligation) on Murray Crows'nest suitable for our requirements. Ladder must reach _____ feet high, and extend _____ feet side-ways. Aisle width is _____ feet.

Name and Title _____

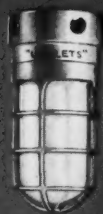
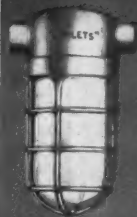
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Address _____

Murray
crows'nest

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Complete Line ON EVERY JOB



VAPORTIGHT

Twenty-four different Vapor-tight types in a range of sizes and options to meet every requirement. Literally thousands of combinations are readily available.

DUST-TIGHT

Ceiling, bracket and pendant types use with or without guards and reflectors, all with three dust-tight seal. Streamlined to prevent dust accumulation.

WHEREVER *Safety* IS A FACTOR PLAY SAFE - SPECIFY APPLETON LIGHTING EQUIPMENT

Safe, efficient, modern lighting for hazardous industrial locations is a field in which Appleton has pioneered; in which the complete Appleton line of Vaportight, Dust-Tight and Explosion-Proof Lighting Fixtures answers every exacting requirement.

The First Explosion-Proof Fluorescent Lighting—a recent, exclusive Appleton development—brings high lighting efficiency and new working comfort to powder mills, oil refineries, chemical

plants, lacquer rooms, rubber plants and other hazardous locations busy night and day in war production.

Designed for use with Appleton Lighting Fixtures are hundreds of "Unilets" and other Appleton fittings which make installation easier, neater, safer. Everything required for any job is supplied from one convenient, dependable source . . . with a considerable saving of time and trouble . . . when you specify Appleton—

"STANDARD FOR BETTER WIRING."

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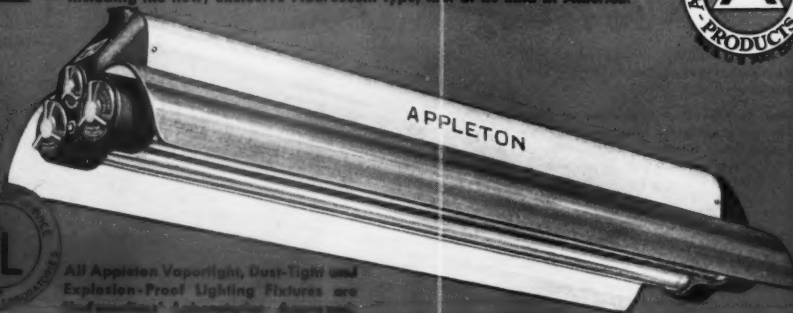
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EXPLOSION-PROOF



A skillfully designed, ruggedly built Explosion-Proof Fixture for every need—including the new, exclusive Fluorescent type, first of its kind in America.



All Appleton Vaportight, Dust-Tight and Explosion-Proof Lighting Fixtures are "Listed" by Underwriters Laboratories.



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REELITES

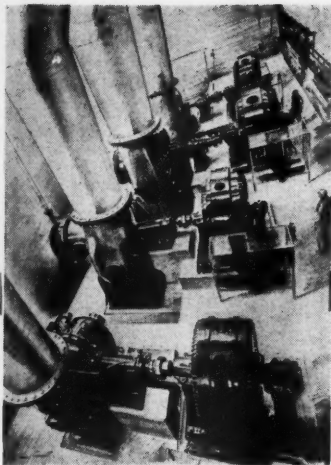
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OUR COVER this month is "Power for Pumps", the second in a series of original sketches of electrical equipment in wartime by Artist Stephen Grout. Copies without lettering suitable for framing are available at 25 cents each.

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A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

Electrical Contracting

With which is combined The Electrician and Electrical News ... Established 1881

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WIREMOLD

WIRING FOR LIGHT . . . FOR WORK

AID to war production . . .

Better lighting begins with better wiring. Motion economy and working efficiency begin with provision of electric power outlets at point of use. WIREMOLD Industrial System-Wiring methods and materials have provided these two production necessities for busy war plants throughout the country and in addition have helped solve many special wiring problems contributing to maintenance of war production quotas.

AID to future planning . . .

Wiremold Engineers . . . and Wiremold Contractors and users . . . are accumulating a wealth of ideas in application that will help industry save time and money in re-converting to civilian production. For example, basic Wiremold installations made now, or written into specifications for post-war projects provide the flexibility essential to take full advantage of future far-reaching developments in lighting, and in the greatly expanded future use of electrical conveniences in every department of industry, office, farm and home.

PLUGMOLD

simplifies lighting
modernization

In the fluorescent lighting installation illustrated above, the advantages of #2100 PLUGMOLD for use in connection with lighting modernization are readily apparent. Note that, by the use of rigid coupling #2101 and a hanger clamp, sufficient rigidity is assured to span beams and also to furnish support for the lighting units. Note, too, that Wiremold Polarized Outlets #2127P permit plugging in of the individual lighting units so that they may be quickly removed for efficient maintenance. The 3-pole receptacles also permit a satisfactory ground. A particularly important feature of this installation is that the Plugmold itself provides a complete electrical distribution system, while the speed and simplicity of installation by Wiremold methods made lighting modernization of this entire factory area possible without interrupting production.

Keep abreast of what Wiremold can do for you today and its potentialities for tomorrow. Be sure your name is on our list to receive new bulletins and data sheets now available or to be issued shortly. Conforms to Federal specifications W-R-32. Listed by U.I. Immediately available on suitable priority.

The Wiremold Company
Hartford 10, Conn.



WIREMOLD

PRODUCE FOR WAR . . . AND PLAN FOR PEACE

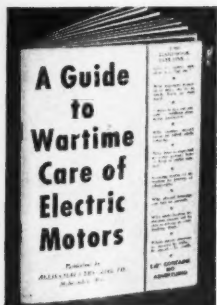


FIRST AID FOR MOTORS

SYMPTOMS YOU CAN SEE

MOTORS RUN A FEVER? No wonder if they do more often today. They're working 3 and 4 times as many hours as in peace!

Wartime conditions demand you diagnose motor ailments *quickly*... remedy the trouble at once. At right are but few of the many diagnoses found in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors". In maintenance as in war, *attack is the best defense*. This book singles out the 9 main enemies of electric motors... tells you how to get them *before* they get your motors!



Over 100,000 copies already in use.

Write today for your free copy. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes. Blackened commutator.	Rough commutator.	Sand or turn down, depending upon depth of surface roughness.
	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet, tightening clamping ring. Grind true.
	Brushes too short.	Replace with harder grade—if worn too soon... and not by rough commutator.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Motor won't start.	Usually line trouble.	Correct. Check source of power supply.
	Load too heavy. See if motor runs without load.	Reduce load—or replace motor with unit of greater capacity.

SYMPTOMS YOU CAN HEAR

4. Excessive hum.	Uneven air gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.
5. Regular clicking.	Matter in air gap.	Take out rotor; remove matter.
6. Rapid knocking	Misalignment.	Realign set until knocking disappears.
7. Brush "chatter."	Extreme vibration.	See item 10, below.

SYMPTOMS YOU CAN FEEL

8. Vibration.	Misalignment.	Realign set.
	Vibration in driven machine.	Eliminate source in machine, if possible. Or a flexible belt drive may be in order.
9. Motor overheating. (Check with thermometer—don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with greater capacity unit.
	Dirt in motor. Check flow of air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubs stator.	Replace bearings.

A 1638



ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.



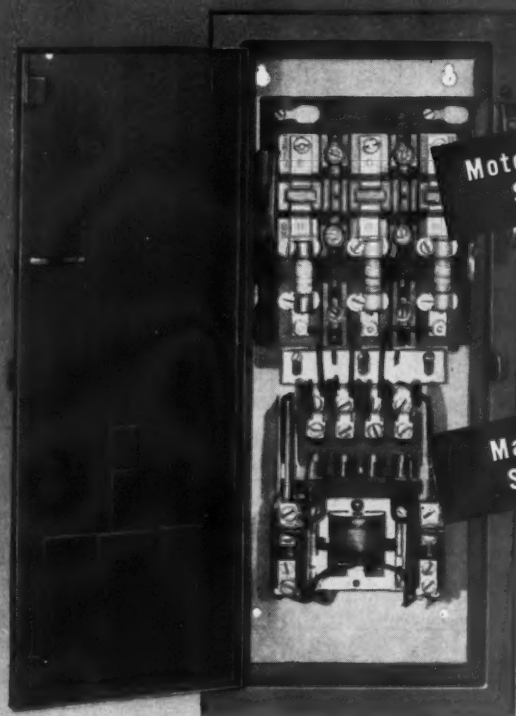
WE WORK FOR
VICTORY

WE PLAN FOR
PEACE

WHY TWO DEVICES?

ONE

CAN DO THE JOB



COMBINATION STARTER

Gone are the days when you had to buy a separate device for each function of motor control. Now, whatever your plant's operating conditions, you can get *combination* control. This means a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit. Look:

50% reduction in mounting time
Mount only one device, not two.

40% reduction in wiring time
Connect to only 9 terminals, not 15. The switch and starter come already connected.

Increased safety

Cover cannot be opened while there is power on the starter.

Reliable motor protection

Protection devices co-ordinated in starter at the factory.

Saving of wall space

The one device takes less space than two.

Improved plant appearance

Single, streamlined case—less open wiring and conduit.

Look over the selection on the next page—and then mail the coupon for more information about the G-E combination starter best suited for your job.

GENERAL ELECTRIC

GENERAL PURPOSE



THE TYPE 1 ENCLOSURE is suitable for general-purpose, indoor applications where atmospheric conditions are normal. Available up to and including NEMA size 5.
INFORMATION IN BULLETIN GEA-3715

CORROSION- RESISTANT



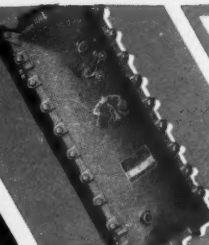
THESE STARTERS are made in two forms—one for corrosive atmospheres (Type 3) and one for hazardous locations (Type 8). All arcing parts and terminals (of forms for hazardous locations) are at least six inches under oil.
INFORMATION IN BULLETIN GEA-3541

DUST- TIGHT



THE TYPE 5 ENCLOSURE is for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so heavy as to make a dust-tight case desirable. The cases are heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.
INFORMATION IN BULLETIN GEA-3715

OR HAZARDOUS LOCATIONS



THE TYPE 7 CASE for Class I, Group D, locations is made of cast, high-strength alloy. These starters are designed to withstand internal explosions. The flanges, which are securely bolted on all sides, are grounded to tolerances that will not permit the escape of hot gases.
INFORMATION IN BULLETIN GEA-3804

WATERTIGHT



THE TYPE 4 CASE is suitable for outdoor use, and for damp places indoors, such as dairies, breweries, and ship docks. The cases are of cast iron, or fabricated boiler plate, with a special weatherproof finish and corrosion-proof fittings.
INFORMATION IN BULLETIN GEA-3715

NEW HIGH-VOLTAGE COMBINATION

This recently developed combination starter provides split-cycle protection and starting means for 2300- and 4000-volt motors.

**INFORMATION IN
BULLETIN GEA-3660**



Which of these bulletins may we send you?

General Electric Company, Section 676-95D
Schenectady, N. Y.

Please send me the publications checked below.

- | | |
|---|--|
| <input type="checkbox"/> GEA-3715 — General purpose, dust-tight, watertight | <input type="checkbox"/> GEA-3804 — For hazardous locations |
| <input type="checkbox"/> GEA-3541 — Corrosion-resistant | <input type="checkbox"/> GEA-3660 — For high-voltage service |

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Address.....

City..... State.....

9820

AMERTRAN ABESTOL IMMERSED TRANSFORMERS



AmerTran Abestol Immersed Net-Work Transformers in the State Department, Washington, D. C. 500 KVA; 3-phase; primary 13,800 volts, 60 cycles; secondary 208/120 volts.

For Safe Indoor Installation!



AmerTran Abestol Immersed Transformers offer no fire or explosion hazards and may, therefore, be located at any point in the building without providing expensive vaults. They can be placed close to load centers, saving long runs of secondary copper and reducing line losses.

This is possible because Abestol coolant has the high dielectric strength of oil without being combustible. Since it will not oxidize or smudge, it requires less maintenance.

And AmerTran Abestol Immersed Transformers have all the other features of good transformer design: high turn-to-turn insulation, linear surge-voltage characteristic, optimum impedance and balanced coil design.

AMERICAN TRANSFORMER COMPANY

178 Emmet Street, Newark 5, New Jersey

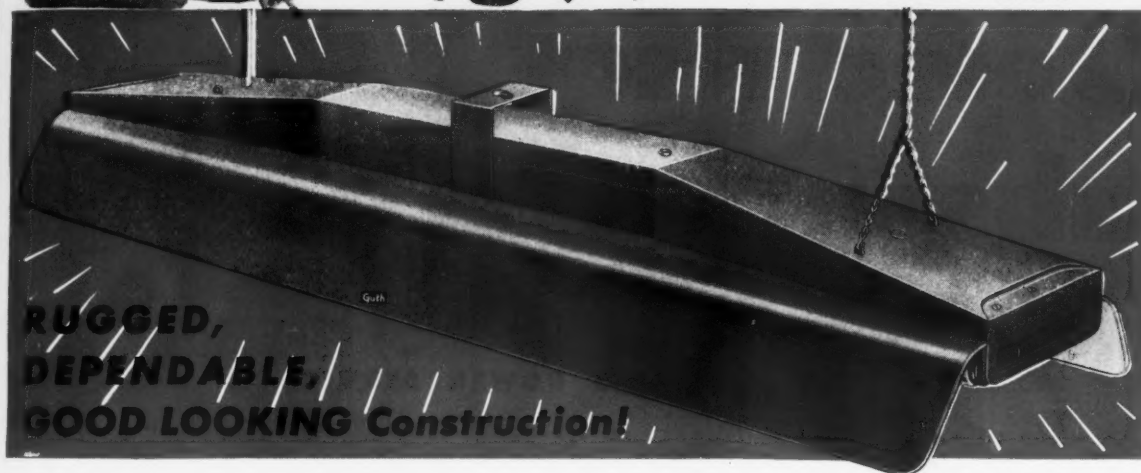


It's DIE-FORMED from a
Single Sheet of Steel



Guth **SUPER ILLUMINATOR**

U. S. T. M. REG. & PATS. PENDING



**RUGGED,
DEPENDABLE,
GOOD LOOKING Construction!**

HERE'S an engineering achievement—a Fluorescent Fixture that conforms to W. P. B. metal limitations—yet its Accessory Housing is completely formed in a single piece so that all operating parts are "under cover" for complete protection! Its unique construction produces an amazingly rigid, substantial unit—with added strength—yet the cost is no higher than that of ordinary Fixtures.

Masonite "REFLECTOR BOARD" Reflectors, finished "300° White" (88% R. F.), are easily removed and reinstalled with a quarter-turn of the "Flexible Trigger".

Fixture is easily installed—hangs anywhere—anyway! Eggcrate Louvers for extra lamp-shielding available if desired. "Bump-Proof" end-plates give added lampholder protection. Starters easily accessible even when fixture is mounted directly to ceiling. Maintenance is fast—easy. Suitable for single or continuous installation. Available in sizes for 2 or 3 40-watt lamps—or 2 100-watt lamps.

Here's Something Completely New in Fluorescent ...the GUTH QUICK-LITER

Here's the last word in Fluorescent development! GUTH QUICK-LITERS are identical to SUPER-ILLUMINATORS except that they are built with special ballasts; perfected for speedy, efficient action. Quick, positive starting... without the use of Starter Switches! Lower operating costs! Tested in use for over a year and approved by users everywhere!

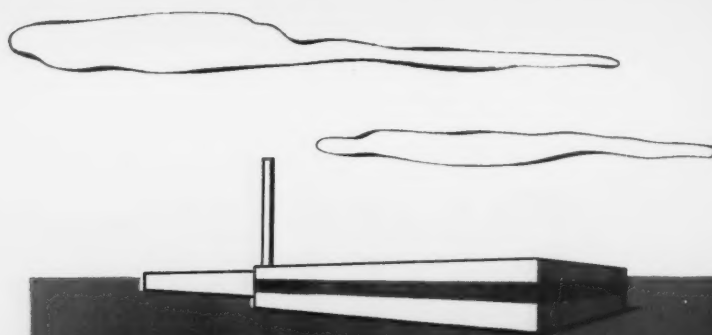
Write or wire collect. A Representative will call with actual samples to demonstrate superiority of these GUTH Fluorescent Fixtures.

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Electrical Contracting, October 1943

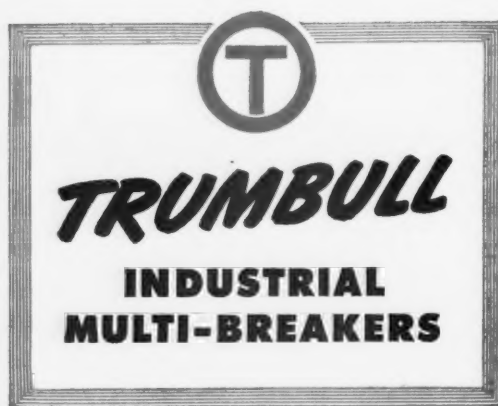


CURE FOR electrical absenteeism..



TRUMBULL INDUSTRIAL MULTI-BREAKERS FOR LIGHT and POWER SERVICE

1. **Protect** vital production equipment and services automatically and positively with simple, low-cost circuit-breaker units that are compact, completely enclosed, non-tamperable and require little or no maintenance.
2. **Prevent** unnecessary production delays due to too-rapid "blowing" of protective devices. Trumbull Industrial Multi-Breakers have accurately calibrated and sealed thermal trips that provide a safe time delay to take care of small overloads. In addition they have a positive instantaneous magnetic trip as sure protection against short circuit or high overload.
3. **Restore** service immediately after the cause of trouble has been removed by a simple twist of the operating handle. Nothing to replace or renew. Tripping is clearly indicated by a target in the front cover.



SAVE TIME...
CUT "OUTAGES"...
GO "MULTI-BREAKER"!!

Available in two sizes for 230 V. AC only. 2 and 3 pole.

Type M-1, 50 amp. frame size, rated 15 to 50 amps.

Type M-2, 100 amp. frame size, rated 50 to 100 amps.

Quick - Make and Quick - Break; Trip Free Operation. Current interrupting capacity 5000 amps, R.M.S. at 230 V. AC.

Boxes are equipped with external front operated handle, self-indicating, which can be locked in "on" or "off" position. Furnished for surface mounting only.

Finish: Baked machine gray enamel.

Trumbullaid Circular 333
sent on request.

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On many applications, variable speed operation offers tremendous advantages. Thousands of alert engineers, like you, have found that the Master Speedranger provides this infinitely variable speed in a compact, all metal unit of proven reliability.

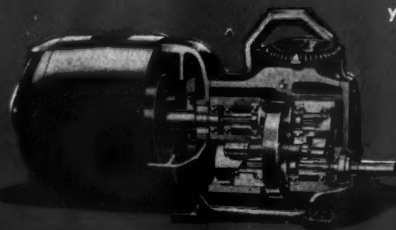
For example, each of the machines shown above use three Master Speedrangers which, in addition to providing the most advantageous speeds, have added greatly to the flexibility, compactness, economy and appearance of the machine.

The Speedranger, on the drive unit on this application, incorporates also a gear reduction unit and an electric brake . . . all designed and built by one manufacturer as an integral, compact power unit. Furthermore, the Speedranger can be supplied in enclosed, splash proof, fan cooled or explosion proof construction, and for flange mounting, or with its construction modified so that the mounting possibilities are practically unlimited.

No other variable speed unit on the market today can give you such flexibility and compactness.

The next time you need a drive for material processing, handling and conveying equipment; mixers and agitators; welding positioners; machine tool drives; testing and calibrating equipment . . . to name only a few . . . see what a really remarkable job Master Speedrangers can do for you.

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO



THERE *IS* SOMETHING YOU CAN DO TO PREVENT WAR PLANT LIGHTING FAILURES



THE RLM LABEL HAS STOOD AS A SIGN
OF QUALITY IN INDUSTRIAL LIGHTING
REFLECTORS FOR MORE THAN 20 YEARS

● What would be the losses in war production if the lighting in your plant should fail? Production losses due to complete or partial blackouts result from many other causes than night air raids. Such "blackout" losses—which are as unnecessary as they are costly—result from (1) too little light for efficient seeing; (2) lighting that causes eyestrain and fatigue; (3) lighting equipment that fails under severe service.

To guard against such lighting failures, insist that the industrial lighting fixtures you install are engineered and built to RLM Specifications. You can be certain you are getting this insurance against "war production blackouts" if your industrial lighting units are certified by the RLM LABEL.

Industrial Lighting Fixtures made in accordance with RLM Specifications...and certified by the RLM LABEL...are designed and constructed with that extra safety factor so vital today. They also provide highest lighting efficiency, maximum power conservation, lowest maintenance cost. Their reflectors of porcelain enamel...the most practical of all known reflecting surfaces for most industrial lighting purposes...are unaffected by mechanical strains, smoke, fumes, grime, dust and atmospheric conditions...are non-porous, easily cleaned, fadeproof, non-peeling and non-breakable. For full particulars write any manufacturer or distributor of RLM Industrial Lighting Units, or RLM Standards Institute.

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

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Without Interest!

A \$500,000 LOAN

AT the end of the first 10 years of operations, The Youngstown Sheet and Tube Company's credit had become so well established that in 1912 one New York bank loaned it \$500,000 without interest. This loan was almost as large as the original capitalization of \$600,000 in the latter part of 1900. This loan was granted on the same sound business principles which operate today...net worth, character and ability to produce.

By the end of 1914 the capitalization of the company had been increased to \$20,000,000 --- more than 30 times the original amount of its incorporation 14 years before. A plant, producing both black enameled and galvanized conduit had been added. Additional coal lands were acquired and other production facilities provided.

In the earlier and more spectacular years, the problems most pressing were those of construction and production rather than distribution. In 1912, however, it was recognized that distribution facilities should be enhanced. The Continental Supply Company, which has served through the years as the distributing subsidiary of Youngstown Oil Country pipe, was organized and sales and service offices established throughout America.

Only because this company was able to earn a profit and reinvest these profits for greater service is it in a position today to contribute materially to a free world tomorrow.

HISTORICAL
SERIES
NO. 6

The YOUNGSTOWN
SHEET AND TUBE COMPANY, Youngstown, Ohio
Manufacturers of
CARBON · ALLOY AND YOLOO STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Tin Plate
Rods - Wire - Nails - Tie Plates and - Spikes - Alloy and Yuloy Steels

Accuracy: + or - 6 inches at

.. How "See-ability" is helping skilled workmen produce range finders of amazing accuracy for the U. S. Army



They said it couldn't be done!

No sir, no one could turn out range finders, eyes for our army's artillery—as accurate as it wanted them—as fast as it must have them!

But that was a long while ago—before Pearl Harbor!

Today, Industry is in quantity production on range finders almost *absolute* in accuracy.

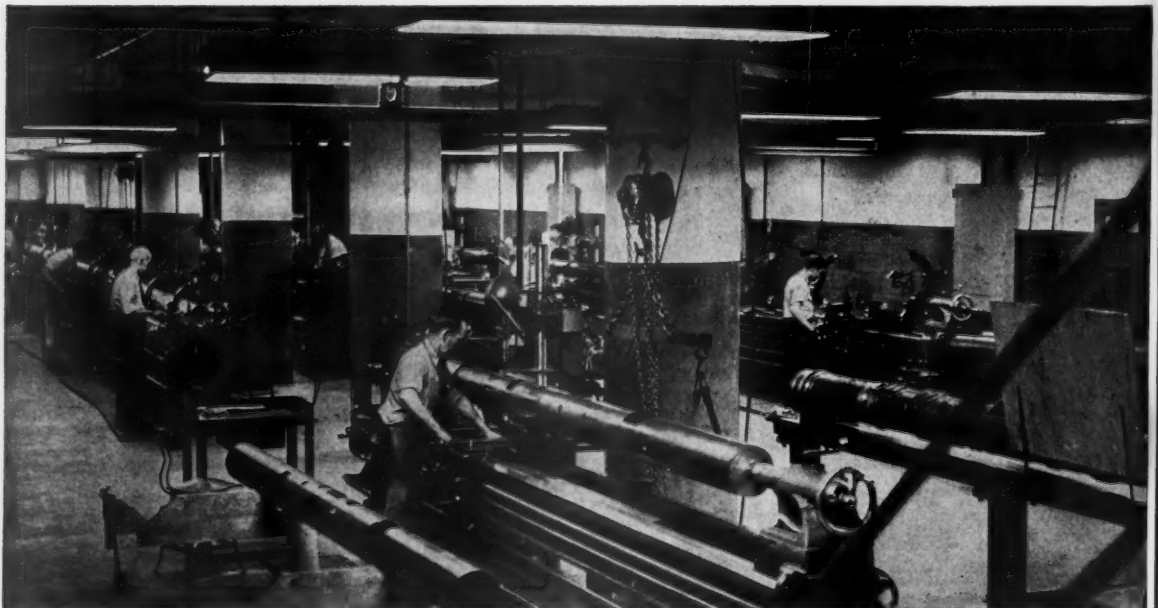
Today, thanks to American *know-how*, gunners all over the world, smack their targets right on the nose!

"See-ability" through better, more scientific, lighting helps make this miracle possible. It is helping make high speed precision machine work a routine matter. It is helping bring well-nigh superhuman skill to human eyes and fingers.

That is why millions of Westinghouse Mazda Lamps are ear-marked to bring "See-ability" to this and other vital war work.

More light for war plants! In many factories, equipment is showing the strain of continuous, round-the-clock production. Especially lighting systems! You can help these plants get more light. Send for free booklet, "See-ability for Indoor Eyes." It is full of valuable suggestions. Westinghouse Electric and Manufacturing Company, Lamp Division, Bloomfield, N. J. *Plants in 25 cities . . . offices everywhere.*

KEEP YOUR DOLLARS FIGHTING . . . BUY WAR BONDS



at better than 5,000 yards!



To find the *infrequently used* . . .



Every now and then—and certainly more regularly today than ever—you're on a manufacturer hunt for some part or piece of electrical equipment *infrequently used*. What's your first move? Pick up your 1943 E-B-R (Electrical Buyers Reference) and let it do your work. Through its convenient Directory Section, its handy Company and Trade Name Index, and *especially* through its 369 pages of BRIEFALOGS* you'll surely find what you want. It can be worth its weight in gold to you today, and every day.

* E-B-R's own original version of modern condensed cataloging.

**IF IT'S ELECTRICAL
...LOOK IT UP FIRST IN
E-B-R**

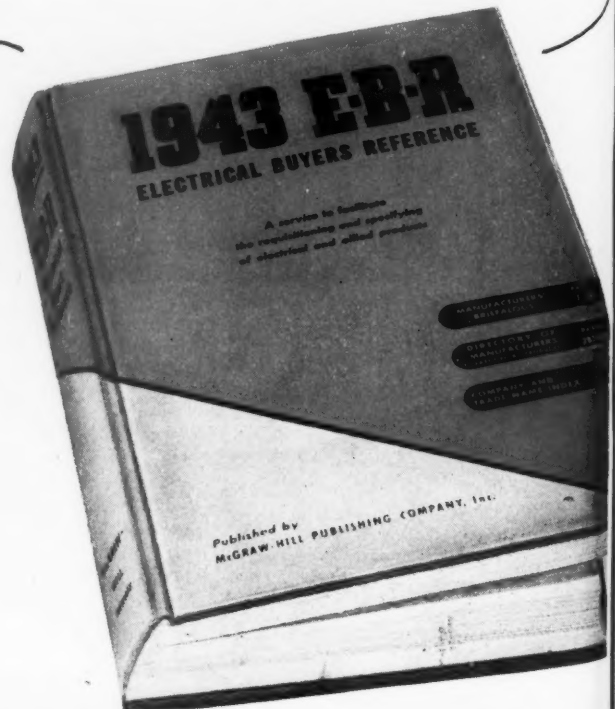
Now more complete than ever before, your 1943 Electrical Buyers Reference gives you:

MANUFACTURERS BRIEFALOG SECTION—Condensed catalogs of 290 manufacturers. Product specifications, branch offices, warehouses, etc.

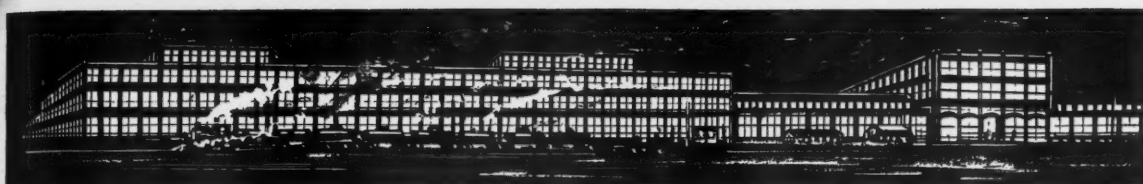
CLASSIFIED DIRECTORY—Company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers.

INDEX OF TRADE & COMPANY NAMES—Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

A WORD OF EXPLANATION—E-B-R is not sold, and is not offered as a premium for subscriptions to any magazine. It is distributed to a limited number of men directly responsible for the specifying or requisitioning of substantial amounts of electrical materials.



MCGRAW-HILL PUBLISHING COMPANY, 330 W. 42nd ST., NEW YORK 18, N. Y.



H & H - SWITCHES

UPHOLD PLANT MAINTENANCE



DIVERSITY of types meets "current" needs for new construction, conversion or replacements. Heavy-duty controls for lighting or power circuits:—specification-grade T-rated 10, 20 and 30 Ampere "Type C" Switches, Rotary Snap Switches, Ceiling Pull Switches, Door Switches, Flush Tumbler Switches with or without outlet box covers.

DEPENDABILITY of mechanisms meets war demands for uninterrupted service on critical jobs. For more than a half-century, H & H Switches have been *tested-by-use* for emergency conditions now general. Among the first in the field, they were long since promoted to the "ranking line" for under-fire assignments the world over.

HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

Electrical Contracting, October 1943

17

INDUSTRY *Speeds-up* with INFRARED

BAKING • DRYING DEHYDRATING • PREHEATING



Reducing processing time from hours to minutes means increased production and lower unit cost.



Processing all pieces under identical conditions means uniform results with a minimum of rejects.



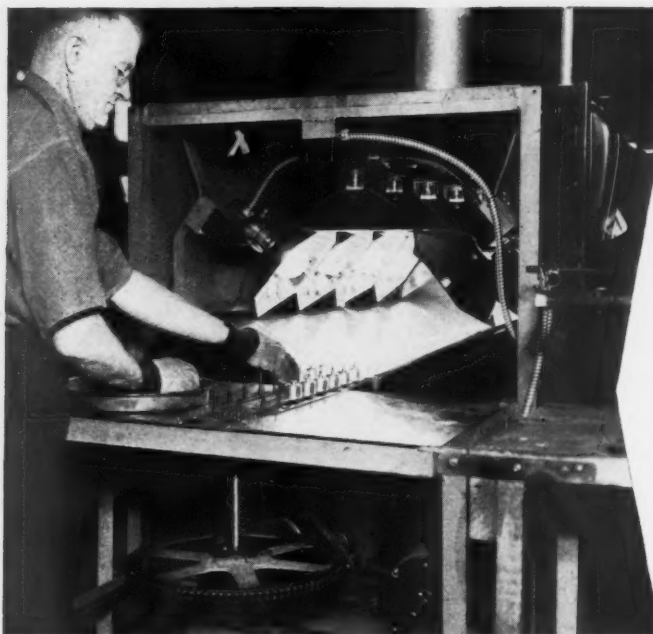
Requiring less floor space means more production per square foot.



Efficient utilization of power means low energy cost per piece.



Reducing overall time for processing means less labor, less handling, and fewer manhours.



**4½ Hours REDUCED
TO 11 Minutes**

This example of an easy-to-install "packaged unit" of Near Infrared equipment has cut the time required for preheating motor commutators from 4½ hours to 11 minutes. The small commutators are placed on conveyor pins which move through the Infrared tunnel and back again to the operator. The installation keeps four staking machines busy and solved a mass production problem. Only 4 KW are required.

The amazing speed, utility and savings of the Near Infrared Process have been applied to hundreds of varying operations throughout industry. Several thousand Fostoria installations are now a vital factor in America's record production of war materiel.

In the coming peace-time production, problems of baking, drying, dehydrating and preheating will bring new widespread employment of the near infrared process. Its remarkable efficiency, so thoroughly proved in wartime emergency, offers competition-wise industrial executives important advantages in speed, quality and economy of production.

Fostoria Industrial Service provides complete facilities for pre-determination of Infrared benefits for your production. Write, today, for further information.

THE FOSTORIA PRESSED STEEL CORP.
FOSTORIA, OHIO

In Canada — Write Amalgamated Electric Corp., Ltd., Toronto



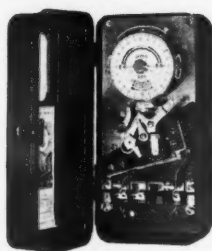
**Call Your
Fostoria Industrial Service Center for
PRETESTING AND RECOMMENDATIONS**

Fostoria Industrial Service Centers, located in principal cities, are properly equipped and well qualified to solve your baking, drying, dehydrating or preheating problem. If their practical tests prove the Near Infrared Process to be a logical solution, the proper equipment to do the job is recommended. The service provides installation supervision and stands by to help the user obtain and maintain forecasted results.

FULL FLOODLIGHT *Protection* FROM *Sundown* TO *Sunrise with* **AUTOMATIC CONTROL**



SANGAMO TIME-SWITCHES } AN IMMEDIATE ANSWER FOR DEPENDABLE AUTOMATIC CONTROL



• Current interruptions up to 10 hours will not stop Form VSWZ astronomic dial time switch nor affect its "on" and "off" settings.

PROTECTIVE FLOODLIGHTING is one method that is used in factory yards, building approaches, railroad sidings, substations, storage yards, and other vital properties. To increase the effectiveness of this lighting—to insure against wrong on and off times of lights, contractors are selling Sangamo Time Switches thus adding Automatic Control. These time switches change the operation of the lights daily to conform with sunset and sunrise. Investigate, then include the form of Sangamo Time Switch best suited for your needs.

Catalog describes all types . . . tells about ease of installation—range of application and dependable construction.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

Electrical Contracting, October 1943

19

NEW

FAIRBANKS-MORSE

MOTOR



WITH *Copperspun* ROTOR

Here is a motor—different from any you have ever seen.

It is a challenge to future motor design—because it includes more versatility, more stamina, more protection than was ever put into one housing before.

● It is a 40°C motor—with a ventilating system you will want to know about! ● It is a protected-type motor! ● It has the most adaptable, convenient, and handiest conduit box you ever laid your

eyes on! ● It has the famous Fairbanks-Morse Copperspun Rotor!

A demonstration is necessary to fully appreciate the many unique features of this motor. You will want to know all about this new Fairbanks-Morse Motor—especially if you are now buying motors for a war task but want them to be up to the minute when the time comes for post-war production.

Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago, Ill., for full information.



FAIRBANKS-MORSE

DIESEL ENGINES

PUMPS

MOTORS

GENERATORS

RAILROAD EQUIPMENT

WATER SYSTEMS

SCALES

STOKERS

FARM EQUIPMENT



Motors

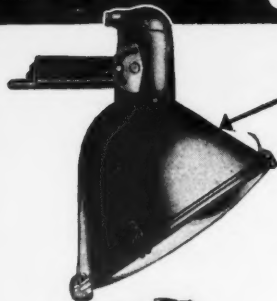
CROUSE-HINDS

offers

IMMEDIATE DELIVERY

on

Floodlights and Searchlights

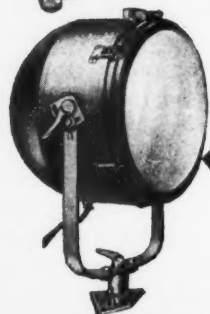


• Type MUA, Light Duty Floodlights

• Easy to service. • Weatherproof. • Cast Feraloy socket housing, (semi-steel). • Reflector. Porcelain enameled steel. • Lens. Clear or stippled heat-resisting glass. • 750, 1000 or 1500-watt lamps. • Degree markings for accurate horizontal and vertical setting of floodlights. • 4 Mountings. Cross arm bracket, pipe slip fitter, wood pole or wall bracket, and vertical or horizontal U-bolt pipe clamp.

Type MUA can be furnished as an open floodlight. The weatherproof door can be added at any time.

Other light duty floodlights that can be shipped promptly are Type MUB in the 200, 500 and 1000-watt sizes; Type MUA Elliptalux and Type MUA Multalux. MUA floodlights can be furnished with an auxiliary reflector that concentrates part of the light into a narrow beam for longer range.



• Type ADE-14 Heavy Duty Floodlights

• A high efficiency unit. Medium and long range. • Weatherproof sheet steel housing. • 14-inch crystal mirrored-glass reflector, narrow or wide beam. • Lens. Clear heat-resisting glass. 50° spread, 100° spread or diffusing lens. • 500-watt lamp. • 4 Bases. Standard, pipe slip fitter, single bolt, and U-bolt pipe clamp.

Prompt shipment can also be made on other sizes of heavy duty floodlights; Types ADE-12, ADE-16, LCE-1120, LCE-24; ADR-12 and ADR-14 portable floodlights; RCD-8 special vaportight and RCDE-8 special explosion-proof floodlights.



• Type DCX-18 Searchlights

• Long range. • Pedestal mounting with ball bearings and pilot house lever control. • Weatherproof steel housing, reinforced at load points by Feraloy castings. • Accurate silvered-glass reflector. • Lens. One-piece, heat and impact-resisting plate glass. • 420 to 2000-watt lamps.

Type DCE-18 searchlights with fixed mounting base and Type DCY-18 with ball-bearing pedestal base for hand directing are also available. Crouse-Hinds complete line of searchlights includes 8, 12, 18 and 24-inch sizes.

Crouse-Hinds is prepared to build special lighting equipment for war applications.

CROUSE-HINDS COMPANY
SYRACUSE, N. Y., U.S.A.

Offices: Birmingham - Boston - Chicago - Cincinnati - Cleveland - Dallas - Denver - Detroit - Houston - Indianapolis - Kansas City - Los Angeles - Milwaukee - Minneapolis - New York - Philadelphia - Pittsburgh - San Francisco - Seattle - St. Louis - Washington
Resident Product Engineers: Albany - Atlanta - Charlotte - New Orleans

CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant, TORONTO, ONT.

A
Nationwide
Distribution
Through Electrical
Wholesalers

MEET THE DEMAND WITH

ILLINOIS

COMPLETELY INSULATED
ALL PORCELAIN WIRING SYSTEMS . . .

PORCELAIN CONFORMS TO THE NATIONAL ELECTRICAL CODE



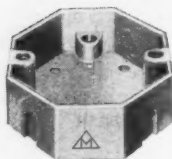
TOGGLE SWITCH
PLATE



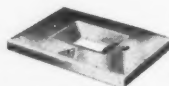
Look for this
Trade Mark



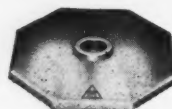
STANDARD TUBES



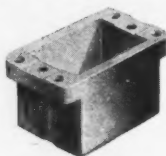
STANDARD KNOBS



SWITCH BOXES
AND COVERS



OUTLET BOXES AND
COVERS



DUPLEX
RECEPTACLE COVER



CLEATS

★ Contractors everywhere know that Porcelain in large quantities is available—that, therefore, they can do wiring jobs today with no let down in wiring quality—that they still can assure customers of permanency, dependability, and economy—that simplified modern installations are the result of the use of All Porcelain Wiring Systems.

This all means continued business for you—wiring goes right along—porcelain products are in demand. So, as those calls come to you for porcelain, be sure you are prepared with ILLINOIS PORCELAIN.

No vital materials go into the production of porcelain, materials do go into porcelain that make these systems durable—that are not affected by rust or corrosion—that make possible full safety—that make these systems valuable where there is dampness and fire hazard.

Illinois all porcelain wiring systems are adaptable to practically all wiring plans and layouts. They can be installed without grounding.

Illinois

ELECTRIC PORCELAIN CO.

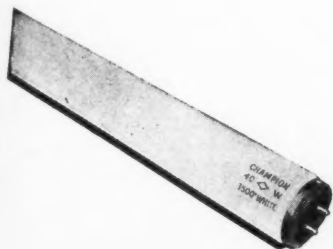
MACOMB, ILLINOIS

FOUR GOOD POINTS TO REMEMBER

... When You Buy Lamps

Whenever you see the four-pointed Champion Diamond on any lamp — fluorescent or incandescent — remember that the four points stand for:

1. CHAMPION CONTROLLED QUALITY — the result of forty-two years of specialization by a top rated organization equipped with every production testing and development resource.



2. CHAMPION RESPONSIBILITY — the product backed by one of the largest and soundest manufacturing organizations in the lamp industry — with a record of successful development that dates back to 1900.



3. CHAMPION RESOURCES — a combination of the most advanced technical and production facilities known to the industry and a product licensed under General Electric Co. incandescent and fluorescent lamp patents.



4. CHAMPION SERVICE — through carefully selected local distributors specializing in the supply of industrial products and equipped to meet emergency needs with the utmost efficiency and economy.

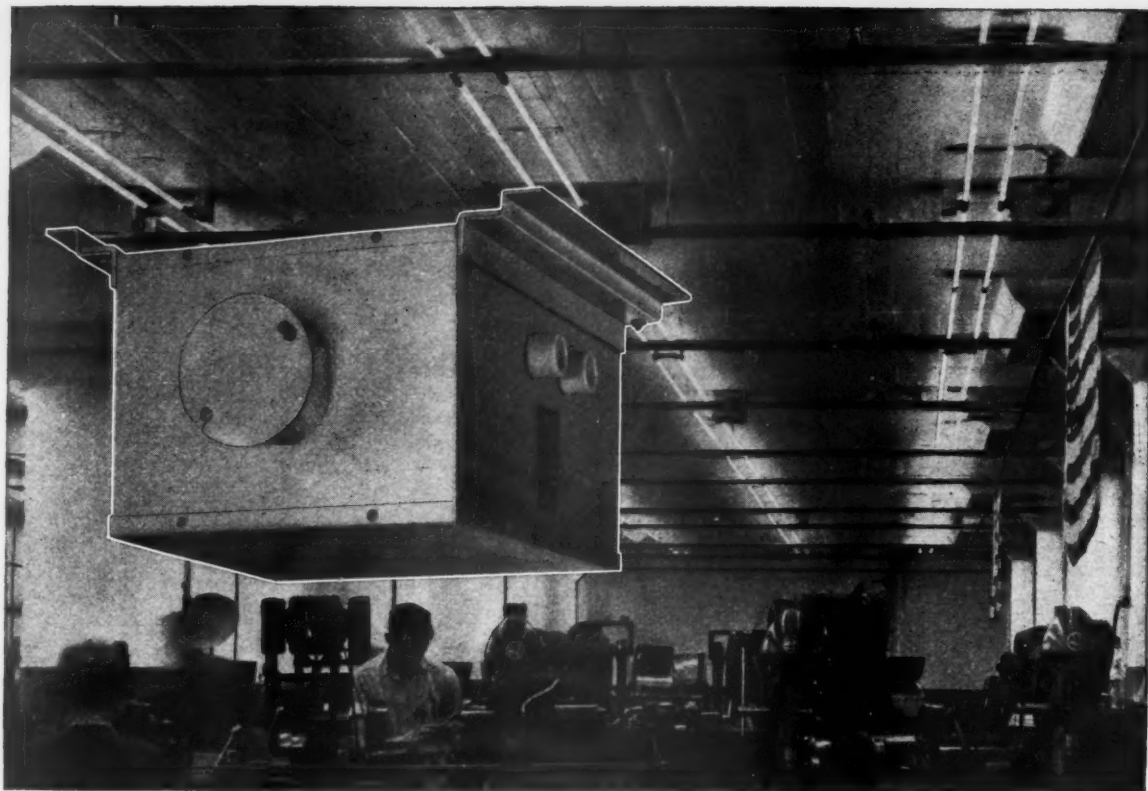


May we put you in touch with the Champion Lamp distributor in your territory?

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.



Helping Cold Cathode offset Manpower Shortage

Industry has found another great reason for its swing to Cold Cathode lighting. *Cold Cathode* is helping offset the manpower shortage. Yes, because Cold Cathode is so intense, so shadowless—and at the same time non-glaring, non-tiring—it gets precision work done faster and more efficiently. It helps workers produce *more* vital war goods with *less* fatigue!

Industry likes Cold Cathode. But keeping industry sold depends upon performance—and that's where illumination engineers look to SOLA COLD CATHODE LIGHTING TRANSFORMERS.

Sola Transformers keep Cold Cathode "on the

beam." They're rugged, unaffected by shock or vibration, built for sturdy service 'round the clock. They assure the kind of operation—free from under-voltage flicker or overload failure—which keeps Cold Cathode doing its full share for victory.

When making installations, keep these two important facts in mind: 1. *The success of Cold Cathode leans heavily on the transformer.* 2. *Every significant improvement in luminous tube transformer construction during the past twelve years has originated in Sola laboratories.* Find out how Sola transformers can serve you. Send for bulletin JI/T-96

SOLA

Cold Cathode Lighting Transformers

Transformers for: Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs • Oil Burner Ignition • Radio • Power • Controls • Signal Systems • Door Bells and Chimes, etc. **SOLA ELECTRIC CO., 2525 Clybourn Ave., Chicago, Ill.**

Free Enterprise

WE MUST ACT TO PRESERVE IT!



LIKE a leaf floating downstream, we are being carried along toward a new and uncharted economy. What this new economy will be like will depend, to no small extent, upon what industry does or fails to do during the coming months. Time is short; in fact, we may suddenly find ourselves standing on the threshold of a peace economy with our war boots still on our feet.

While bending every effort to win the war, we cannot afford to be caught unprepared for the peace. As Prime Minister Churchill said at Harvard, we are "bound, so far as life and strength allow and without prejudice to our dominating military task, to look ahead to those days which will surely come, when we shall have finally beaten down Satan under our feet and find ourselves with other great Allies at once the masters and the servants of the future." Unless we do look ahead, there is danger that we may become neither the masters nor the servants, but merely the victims, of the future.

The war has quickened our ailing economy and opened our eyes again to the possibilities of peace-time plenty. But it has also brought great dislocations of labor and capital; it has led to abnormal patterns in prices and income distribution; and it has created inflationary pressures with enormous potential powers to injure or to help us in the transition from war to peace.

The pattern of life in postwar America will be just what we make it. All of us will have a hand in shaping that pattern, but business men will have a special responsibility in the reconstruction. As employers of labor and capital and as enterprisers assuming the risks of new ventures, they will have to plan and carry out the conversion from war work to full peace-time production. Because of their key role, business men have a special opportunity to discover, and to help others to understand, the conditions which are necessary if they are to do their job satisfactorily.

This is a narrow view of postwar problems but it is a central view, because no one condition is more vital to the health of the world than a high level of production and employment in the United States. We cannot hope to lead the world out of economic chaos if we fail to put our own house in order. If we fail to adjust our domestic economy, we may destroy Adolf Hitler; but we will not destroy the germ that breeds "Hitlers." If we do not maintain the production necessary for supporting a large volume of imports and exports, then the plans for international monetary stabilization, for good relations with our neighbors, for rehabilitation of stricken countries, and for strengthening the democratic bulwarks against dictatorship are all likely to come to grief. We must demonstrate our capacity for world leadership, or be content to follow the leadership of others.

The prospects for achieving a sound and vigorous economy in the United States are not so good as to warrant complacency on the part of men genuinely interested in free enterprise and the political freedoms incident to it. We have yet to find means to utilize our vast and abundant resources for the good of all. We have yet to learn how to keep men from the terrible experience of unemployment and the fear of want which makes them willing to sacrifice freedom and opportunity for almost any promise of security. We have yet to reconcile the conflicting interests of labor, agriculture, and business so that they can work together effectively. We have yet to learn how to check the fever of inflation and cure the palsy of depression.

When we were attacked at Pearl Harbor, we realized our physical peril immediately and united in a tremendous common effort against the enemy. The onset of economic perils is less obvious. No bombs will signal the deterioration of the private enterprise system, the extension of regimentation, the further control of busi-

ness by government, and the concentration of political power in less and less responsible hands. If these things should befall us, they will come insidiously while we are preoccupied with self interests and oriented by popular misconceptions. If the freedoms of the individual shrivel as the state grows in power, it will be because the individual is too indifferent or complacent to concern himself seriously with economic problems. If our people are misled by false prophets and demagogues, it will be because business men did not understand economics, because scholars were too ignorant of practical affairs, and because we failed to produce economic statesmen of sufficient stature for the task in hand.

Thinking is hard work. Thinking about things outside our personal experience, about economic processes that are broader and in some fundamental respects different from buying and selling or running a business — is strenuous mental labor. Thinking straight about problems that are beyond our personal and immediate status and our pocketbooks, thinking about problems that involve nation-wide production, nation-wide employment and nation-wide buying power — in other words the operation of our entire economic system — involves real self-discipline. Yet there is no other way to safeguard our freedoms. We cannot rely on trial and error; tinkering takes too long; social experiments which turn out wrong can be undone only at great cost — if at all. If we proceed blindly, we shall flounder into an economic and political morass from which we cannot escape.

We floundered badly all through the Thirties, until the war lifted us temporarily to higher ground. When the war boom is over, we shall be back floundering worse than ever unless we find a solid road along which to proceed.

America has grown rich and strong under a system of political and economic freedom. Opportunity and the necessity of self-reliance have brought forth great accomplishments. The hope of profit and the spur of competition have urged men on to find new and better products, new and better methods, and to risk their savings in pioneer investment. Never has a country achieved so high a standard of living and afforded so large an opportunity for the individual man and woman. It is not surprising that some distinguished business leaders, looking back over their own experience, tell us that everything will be all right if only there is "less government in business."

I wish the solution were as simple as that. However this is only part of the answer. It is becoming in-

creasingly clear that industrial capitalism as we know it contains within itself certain fundamental weaknesses which can lead to its destruction if they are not counteracted. No democracy can survive when twenty to thirty per cent of its workers cannot get jobs. That happened here in the Thirties. For years on end, despite fumbling efforts at recovery one out of every five workers was denied a chance to earn a living in private business. We shall never again have such mass unemployment as occurred in the bottom of the Depression, because the government will take it upon itself to create jobs if business cannot offer them. Whenever that happens, however, the area of private enterprise will be reduced and that of government will be expanded — and the concentration of political power will be increased. This is the challenge we business men face today, and ours is the first opportunity at finding the solution.

The crux of our economic problem is unemployment. Unless there are jobs for ninety to ninety-five per cent of those who are able and willing to work, there will be widespread fear and lack of opportunity, which will drive labor unions, agricultural groups, and business interests to take self-protective measures. Such measures are certain to restrict production, stifle progress, and imperil our democratic way of life. Not all our problems will automatically be solved if we learn how to avoid mass unemployment, but they will at least then have a good chance of solution.

And so American businessmen face a great responsibility! We will have to find the answer to a great many momentous questions. We will have to delve into problems that cannot be solved by precedent.

Looking backward to these times, future historians are likely to say that here we Americans stood at the crossroads and, consciously or not, made our choice between a system of private enterprise and personal freedom and a system of collectivism and regimentation.

It is particularly appropriate, therefore, as the problems of our time take shape and as events rearrange their order and importance, to appraise the steps we are taking and point the way we are going. It is my plan to present such analyses from time to time to the one-and-a-half million readers of McGraw-Hill publications.



President, McGraw-Hill Publishing Company, Inc.

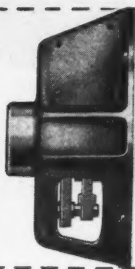
Be Ready for the
POSTWAR MARKET
with Revolutionary

R & M Uni-Shell INTERCHANGEABLE MOTORS

ONLY THE END
 HEADS CHANGE



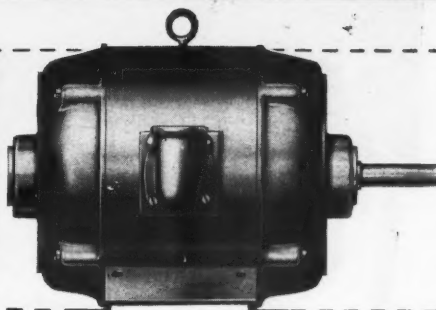
CAPACITOR
 SINGLE-PHASE
 INDUCTION MOTOR
 1-5 H. P.



D. C. MOTOR
 AND GENERATOR
 1-7½ H. P.
 ¾-5 H. P.



REPULSION
 INDUCTION
 MOTOR
 1-5 H. P.



POLYPHASE
 INDUCTION
 MOTOR
 1-30 H. P.

READ ABOUT THESE *Uni-Shell* ADVANTAGES

1. Complete interchangeability in any one frame size.
2. Trouble-free bearings and improved insulation for longer life.
3. Many interchangeable flanged end-heads for vertical or horizontal mounting.
4. Adaptability to drip-proof, splash-proof and totally enclosed fan cooled construction.
5. Polyphase induction, Direct Current and Single-Phase Induction types.

COMPLETE INTERCHANGEABILITY WILL HELP SPEED PRODUCTION CHANGE-OVER

Whether you are a producer or user of machine tools, you can profit from the interchangeability and exceptional efficiency of R & M Uni-Shell Motors. No other motors can offer these advantages for postwar conversion and operation. In all Uni-Shell types, the shell length, diameter, base mounting holes, shaft dimensions, height of shaft above base, head fit and bolt circle mounting for heads are exactly the same for any frame size. Only the end opposite the shaft extension varies from one type to another.

This feature of interchangeability represents a great advance in motor building—but there are other features of comparable value. Improved insulation techniques, trouble-free bearings and alignment, precision-balanced rotors, and lower interior temperatures are remarkable achievements, too.

Get the full facts on Uni-Shell integral horsepower motors. Mail the coupon for the interesting, informative 20-page Uni-Shell booklet.

Mail This Coupon Today!

ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

Name.....Position.....

Company.....

Street Address.....

City.....State.....

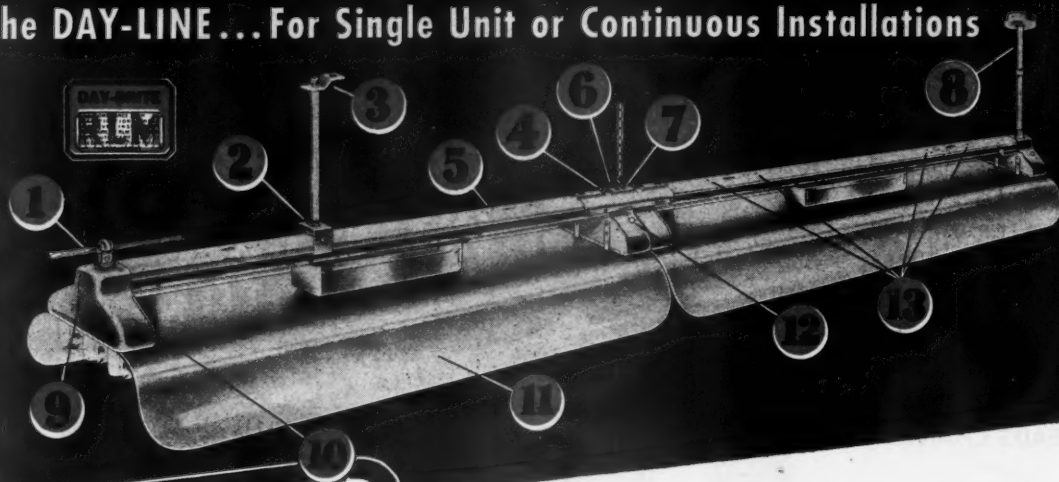
I would ☐ would not ☐ like to talk to a representative. EC7

ROBBINS & MYERS • INC.

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

The DAY-LINE... For Single Unit or Continuous Installations



- 1 1/2" K.O. for cable clamp installation direct to fixture.
- 2 Slide channel clamps for rod or pipe hangers can be located at any point on channel.
- 3 Swivel type hanger strap is adjustable for pipe or rod alignment.
- 4 K.O.'s for pipe.
- 5 K.O. for cord.
- 6 Rigid one-piece coupling connects, single units to continuous fixtures.
- 7 Chain hanger slots in top of channel and in center of coupling.
- 8 Complete pipe hangers with ceiling canopy and all fittings.
- 9 K.O. in end for through feed.
- 10 Rigid, one-piece, die-formed end boxes welded to channel assure rigidity and proper alignment of all parts.
- 11 Non-metallic reflectors (RLM and U. S. Bureau of Standards approved). Reflection factor, 85% or more. Angle of cutoff, 14°.
- 12 K.O. for switch.
- 13 Screw holes for direct surface mounting. No couplings needed.

13 POINTS OF FLUORESCENT LIGHTING SUPERIORITY

In this new Day-Line Industrial Fluorescent Fixture, thirteen superior features give you the ultimate in lighting—now and from now on! Day-Brite's "Super-White" baked enamel finish on non-metallic reflectors assures continuously high illumination efficiency. Unusual mechanical, installation and maintenance features are illustrated above and briefly described in the panel at the left.

The same basic Day-Line Fixtures are supplied for single unit mounting or continuous runs for 2-40 Watt, 3-40 Watt and 2-100 Watt lamps. Send for helpful dimensional, specification, and illumination data contained in Bulletin F-69.

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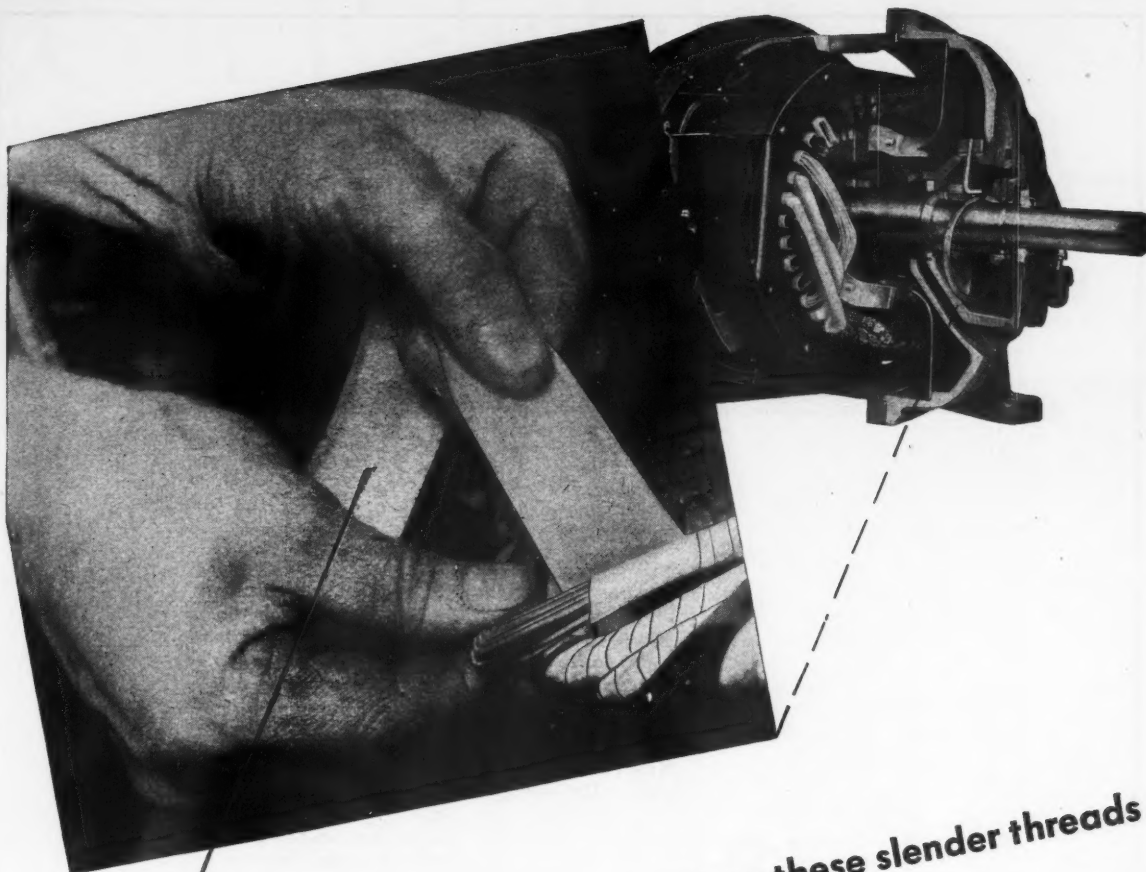
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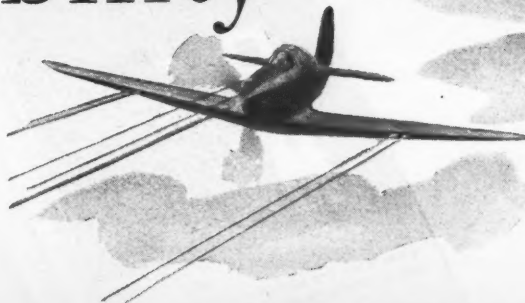
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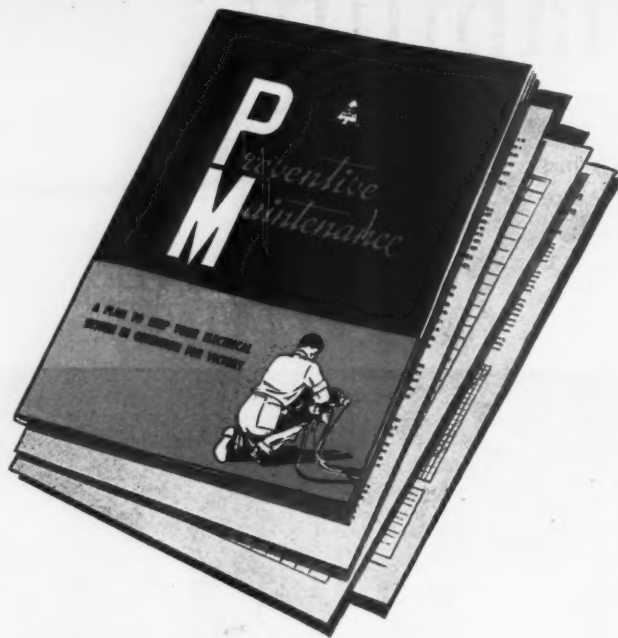
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Electrical Contracting, October 1943

29



Industrial Plant Maintenance

— ESSENTIAL CONTRACTOR WAR SERVICE —
AIDED BY THE **PM** PLAN

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To aid contractors in this vital activity is Anaconda's aim. With this in view, the Preventive Maintenance Plan was designed. Although introduced only recently, over 12,000 free Plan Manuals have already been sent out on request.

1

WHAT THE PLAN IS

The PM plan is a simple but comprehensive guide which can help you maintain electric wire and cables in busy war plants and thus help safeguard continuous peak production.

2

HOW IT WORKS

The plan provides a practical means of making a periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

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NOTE: Your Anaconda Distributor will gladly cooperate in working out the program.

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HOW THE CONTRACTOR BENEFITS

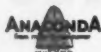
The PM plan assists in carrying out the all-important maintenance program. Helps keep business going and trained personnel together during construction lull . . . enables contractors to put employees on an annual, rather than hourly, wage rate . . . helps keep old customers, gain new ones, despite lack of products to sell . . . puts electrical contractor in leadership role for furthering the war effort.

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101

Electrical Contracting

FOUR QUESTIONS

The streamlined annual convention of the National Electrical Contractors Association will be held this week in Chicago. It is important. It comes at a critical time. And while interest is focussed on industry affairs, there are some pressing questions that contractors everywhere ought to be thinking about. Some of them bear on the immediate postwar period, others are concerned with long range planning, but the future of the industry in which we have all chosen to throw our lot depends on finding the right answers, and soon.

1. Can we disconnect or rebuild duration wiring? Some is located in municipal areas where strict and enforceable ordinances can require disconnection or condemnation by the inspector. More, however, is installed in localities where disconnection cannot be enforced by law. We shall face a critical and difficult task and the entire electrical industry ought to be ready to speak with one voice.

2. Can the electrical construction industry create jobs for returning servicemen? As an important element of the construction industry we shall have work for thousands of skilled wiremen in proportion to postwar construction activity. However, more skilled men will come out of the armed forces than went in. Can we absorb them by an aggressive lighting sales, industrial service and other activities not related to construction? Electrical contractors are in a key position to do so.

3. Can efficient tooling, financing and job management stabilize business practices at profitable and strongly ethical levels? It can if able and competent men find substantial economic careers in established contracting firms. It can't if the ambitious man must "go into business for himself" to cash in on his ability.

4. Can the engineering function of the electrical contracting business support good engineering talent? War experience has proved that it can. Electrical construction ought to offer careers to a substantial percentage of electrical engineering graduates from our universities. But progress will depend on how aggressively we solicit and assume engineering responsibilities. There is the further problem of publicizing the importance of this engineering function. Most engineering work by the contractor during the execution of the contract goes unrecognized and consequently unpaid for.

The latter questions are not strictly postwar problems but they belong to this era. Our industry is in a state of flux. Major market changes are in prospect. Probably at no period in industry history has the opportunity for swift progress been so apparent.

Wm. J. Stuart

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Electrical contractors know the importance of "getting in early" to work with architects and builders. The advertisement below, appearing currently in "THE ARCHITECTURAL FORUM", will encourage more effective use of your experience and facilities. It's one phase of Graybar service to qualified contractors — a service which includes everything you need in supplies.



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New developments in surface wiring may mean a big gain in economy and convenience for those new buildings you contemplate. Then again, conditions may call for a conduit job when all the facts are in.

Local building regulations, climatic conditions, buyer preferences in the area — a multitude of factors affect electrical decisions like this, whether they involve wiring practices, installation methods or the choice of equipment. It takes a specialist to know them all.

The best way to get the answer is by talking it over with "John Watts," a well qualified electrical contractor familiar with all the local conditions, regulations, likes and dislikes. The chances are his practical experience will point the way to the most acceptable result, and to faster completion of the job.

Today, as never before, early contact with a competent contractor can help you steer clear of "extras" and delays. Choose your electrical contractor carefully, of course, but once you do, give him a real chance to put his expert knowledge at your service right from the start.

Give Your Electrical Work to John Watts, a qualified electrical contractor heading a well-established firm with the trained organization, tools and know-how to give you specialized assistance on wiring, lighting, signaling, power supply, electronics. From offices and warehouses in over 80 cities, GRAYBAR serves a nation of "John Watts," helping them to help you by supplying the newest and best in electrical materials.

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EMERGENCY WIRING for ORDNANCE

By August Eckel



OUTDOOR DISTRIBUTION system consists of numerous weatherproof Transite cabinets housing standard equipment fed by same size cables and duct that originated at the transformer.

A new duration wiring idea, combining non-metallic sheathed cable and explosion-proof equipment, sped the Oak Ordnance Plant to completion in the face of critical material shortages.

OUR entrance into the war released an avalanche of industrial construction such as this country has never before experienced. Riding this wave of activity was good old Yankee ingenuity devising methods of speeding construction, substitutions for critical materials, increasing the quality and quantity of production, making the most of the materials at hand—all directed toward that common goal of getting fighting equipment to our service men.

A good portion of this ingenuity went into the construction of the Oak Ordnance Plant which, nestled in the cornfields of Illinois, is now working around the clock to pour out ammunition. Built, under the supervision of the U. S. Army Engineers, by Bates and Rogers Construction Corp., Chicago, in joint venture with Chas. W. Cole and Son, South Bend, Ind., architect-engineer on the project, this plant typifies "duration" construction—wood framework with asbestos siding and roofing. The biggest problem confronting the contractor's engineers was that of speed in the face of rising critical material shortages—a

problem that naturally extended to the electrical system installed, under subcontract, by the A. S. Schulman Electric Co., electrical contractors of Chicago.

Steel for conduit was becoming increasingly tighter. Priority delays and lagging shipments meant postponing the date of plant operation and hence production. So the engineers went into a huddle to see what could be done to speed the installation and lick the materials problem. They decided to use what material was available to do the job at hand and came up with a new duration wiring scheme credited to

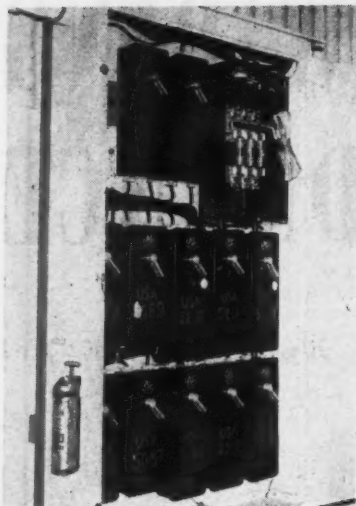
Robert F. McCaw, then chief electrical engineer for the joint-venture group.

The scheme was simple—outdoor feeders and distribution centers with non-metallic sheathed cable circuits for interior wiring to explosion-proof equipment. It took a good deal of deliberation and courage on the part of the engineers to propose such an unorthodox installation in a hazardous area. After careful consideration of the performance and safety angle, they decided to use synthetic or rubber insulated non-metallic sheathed cable on interior branch circuit runs—material

NOT EXPLOSION-PROOF . . . this article concerns an unusually ingenious wiring scheme to save critical materials. Explosion-proof fittings at all points of switching and utilization were used to insure safety from flashes. The wiring, however, is in non-metallic sheath cable. This is not, in the conventional sense, explosion-proof wiring.

The system was designed by competent engineers after full consideration of the hazards involved. The workmanship is precise and it is constantly supervised by extraordinarily rigorous maintenance. And it is distinctly a duration job.

It is our opinion, that, as a rule, anything less than the best mechanical protection in hazardous area wiring is an invitation to disaster. Whether critical material shortages and the specific conditions under which the wiring will be installed and used justifies a compromise with that rule rests, of course, with the competent and reasonable judgment of those who have all the facts at hand. **EDITOR**



TYPICAL POWER CABINET contains main disconnect switch and groups of motor starters. Note non-metallic sheathed cables leaving starters and thermostatically controlled electric strip heater for winter use. Cabinets are Transite.



LIGHTING CABINET contains standard fused main switch, magnetic contactor for blackout control, fuse-type branch-circuit load center and small panel for emergency lighting units. Cabinets are installed outside of powder dust areas.



ENTRANCE BOX at back of Transite cabinet is filled with sealing compound to prevent powder dust from following cables into panel. After leaving box, non-metallic sheathed circuit cables fan out to serve lighting units. Power panels are similar.

which was readily available and which they felt would do the job.

Conditions which influenced their decision included:

1. The plant had to be completed and in operation as soon as practicable.

2. Explosive gases and vapors would not be present and there would be no moisture condition affecting interior wiring.

3. Explosion-proof and vapor-tight fittings and sealing fittings would be used to terminate cables in switch outlets, junction boxes, lighting units and motors.

4. What powder dust there would be in the atmosphere could not permeate even the outer covering of the non-metallic sheathed cable.

5. The cables would be installed high above the work area and out of danger of mechanical injury. Circuits running down walls would be enclosed in conduit or other mechanical protection and properly sealed before entering outlet boxes or terminals.

6. Circuit breakers and non-tamperable fuses were to be used throughout with individual circuit protection care-

fully engineered. Overloads were not to be tolerated.

7. Very strict maintenance and supervision of the electrical system was to be maintained at all times.

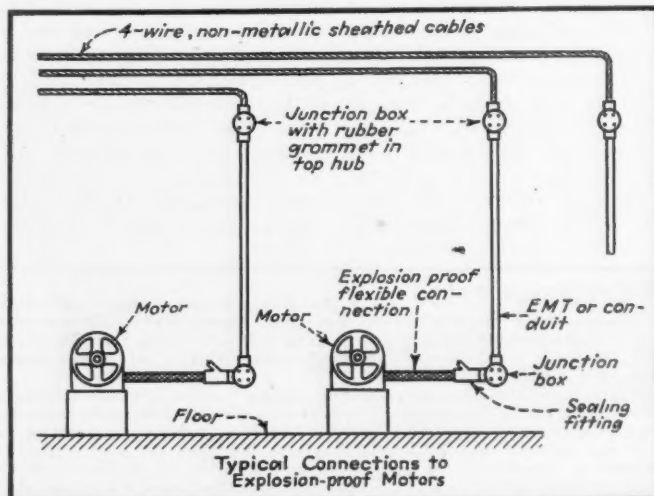
8. All loading line buildings were to be vacuumed and cleaned each day to prevent accumulations of powder and dust.

9. The wiring was to be of "duration" type.

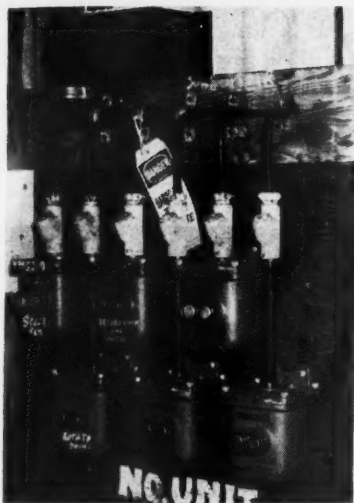
Outdoor Distribution

The entire electrical system uses non-critical materials to the greatest advantage. The general distribution scheme is of conventional design with overhead pole lines transmitting 13.2 kv. power to the various shell loading lines, located about one mile from each other. Each line is, in effect, a separate and individual operating plant. One or more pole-mounted transformer substations serve each line, depending upon the connected load. In general, these subs transform the high line current to three-phase, four-wire, 120/208-volt secondary current for power and lighting service to the buildings. The only departure from this standard is in certain lines where 440-volts are used to serve highly concentrated power loads. However, in most of the shell loading lines, the major electrical load is lighting.

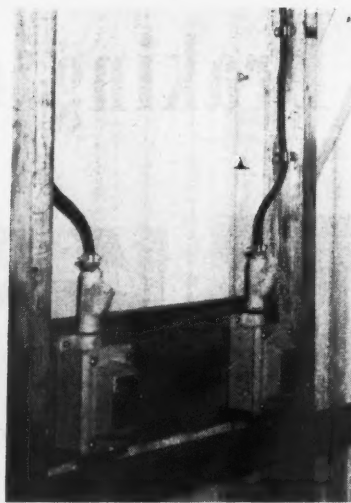
Secondary feeders leave the pole transformers and go underground in Transite conduits to the first outdoor



BRANCH CIRCUIT DROPS to explosion-proof motors are protected by E.M.T. risers topped by a junction box. Motor connections are made through a sealing fitting and an explosion-proof flexible connection.



REMOTE CONTROL buttons of explosion-proof type control motors in the shell loading areas. Note the sealing fittings with ordinary cable clamps to grip the non-metallic sheathed control circuits. Conduit is extended to buttons.



SWITCH LEGS of non-metallic sheathed cable enter explosion-proof lighting switches through sealing fittings. If cable were run on front edge of wood support, it would have been protected from mechanical injury by half-round wood molding.



TYPICAL FIXTURE connection to the non-metallic sheathed lighting circuits. Note rubber grommets around cable entering hubs, making a dust-tight fit. In some cases "T" conduit fittings are used. This dust-tight unit is typical of those used in the loading lines.

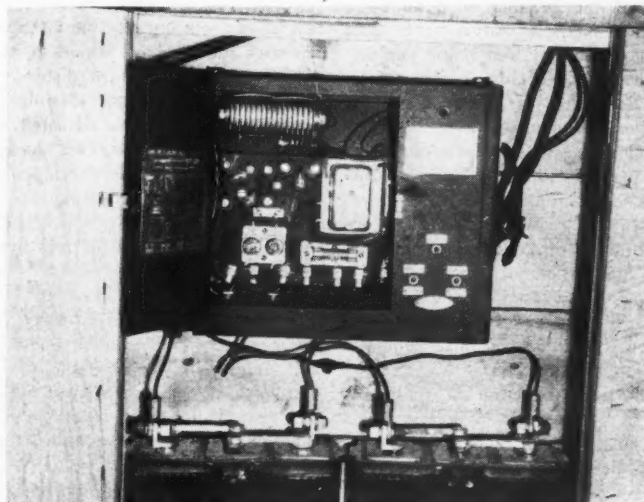
distribution center on the side of the building. The same size cable and Transite duct extend from this cabinet to serve other lighting and power distribution centers on the side of the building—as many as eight or ten to a substation.

These distribution centers consist of weatherproof Transite cabinets which house conventional standard control equipment. A typical power panel includes a fused, three-pole, main disconnect switch and groups of combination disconnect and magnetic motor starters. Remote control pushbuttons of the explosion-proof type are mounted inside the building. Lighting load centers are housed in similar cabinets and include a three-pole, fused, main disconnect switch which feeds a magnetic contactor for blackout purposes. Connected to the contactor is a fuse-center panel equipped with 15-amp. non-tamperable plug fuses. Tied in with the main switch, but separate from the contactor, is a small panel controlling emergency lighting units. All out-door panel enclosures of this type are equipped with thermostatically operated strip heaters to maintain safe operating temperatures during winter months. As an added precaution against being without any light at all should there be an outage on the high line serving the loading lines, each building is equipped with a number of storage battery banks. These are housed in wood cabinets outside the buildings—each containing two, wet type, 6-volt storage batteries connected in series to serve

approximately fifteen, 50-watt, 12-volt lighting units located at strategic points throughout the building. If there should be a power failure, these batteries are automatically placed in service and will carry over for a short period (usually from $\frac{1}{2}$ to 1 hour) until power can be restored. Once power is restored, the batteries are automatically taken out of service and placed "on charge" so they will be up to capacity for another emergency. A control panel with each set of batteries contains the automatic relays and battery charger.

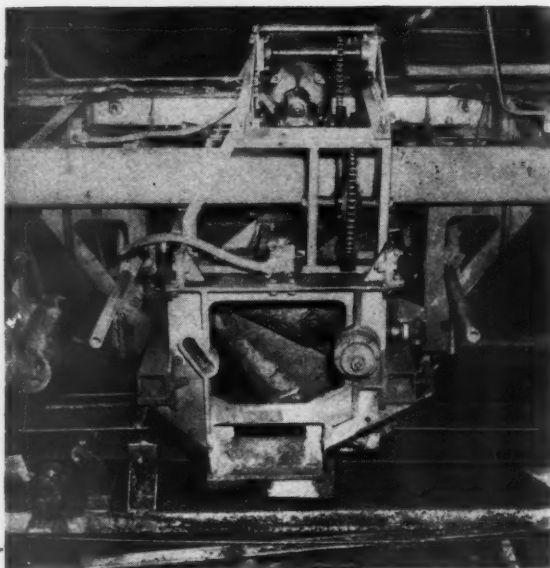
All power and lighting units in the shell loading areas, with the exception of short runs immediately adjacent to extremely hazardous equipment, are fed by individual circuits of three and four-wire, non-metallic sheathed cable with an insulated neutral conductor. The cables are mounted with two hole straps to the wood framework high above the work area to prevent mechanical injury. Wherever possible, switch legs for lighting units are mounted on the inside of the two by four supports. If the

[Continued on page 144]

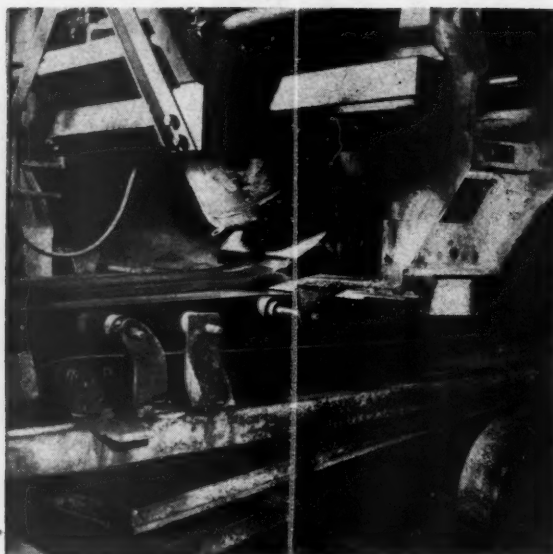


STORAGE BATTERY BANKS mounted in outdoor cabinets feed a 12-volt emergency lighting system used only for short periods during a total power failure. Control panel has automatic relays.

Dynamic Braking of Squirrel



THIS UNDERSLUNG CARRIAGE rides back and forth on rails mounted above the conveyor belt. The carriage is driven in synchronism with the conveyor for a predetermined distance and is then returned. The car motor is mounted above to drive the knife motor back and forth.



THE KNIFE MOTOR can be seen mounted up in under the carriage at about a 30° angle to the vertical. The photo was snapped as the knife whizzed through a section of cold uncured rubber tread. The knife makes a return cut after the motor has been braked and reversed.

REPETITIVE sequence braking of a.c. motors generally presents a maintenance problem of some proportion if the braking is done by a mechanical method. Adjustments must be made frequently and lining replacements become excessive as severity of the service increases. Because of these mechanical maintenance problems and to obtain more constant and accurate braking torques the Goodyear Tire and Rubber Co. of Akron, Ohio has achieved very gratifying results with d.c. dynamic braking of a.c. motors. One particular application of this method is that used on tire tread skiving machines where two motors are required to start and stop simultaneously on a comparatively rapid duty cycle.

The skiver's function is similar to that of a flying shear in that it cuts a continuous strip of rubber tread stock into the desired tire length. The machine is constructed similar to a traveling crane where the main part called the "carriage" moves on rails supported above a moving conveyor belt. The

By R. F. Snyder

**Goodyear Tire & Rubber Co.
Akron, Ohio**

belt moves continuously in one direction whereas the carriage moves with the belt for a predetermined distance only and then returns to the starting point. The distance moved is adjusted in accordance with the required length of tread being run. The carriage movement is accomplished through a chain and sprocket mechanism which is driven by the same motor that drives the conveyor.

On the carriage is mounted a "car" which travels on rails laterally across the carriage. This car is pulled back and forth across the carriage by a chain and sprocket which is driven by a two hp. gear motor also mounted on the carriage. This motor is called the car motor.

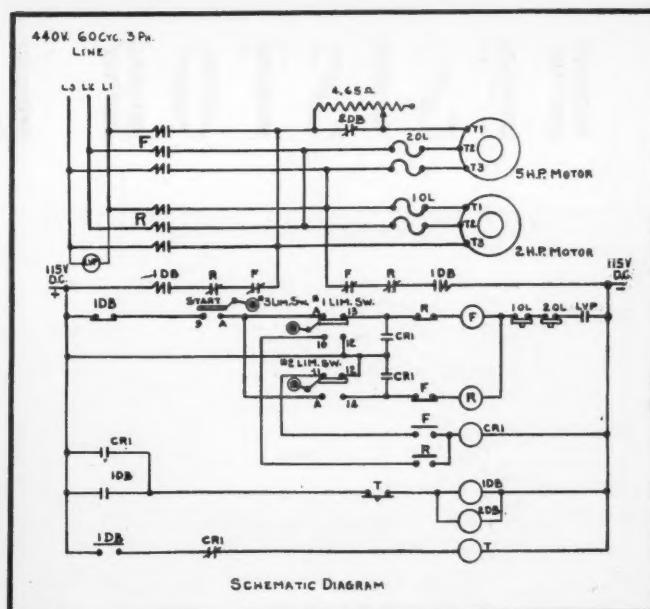
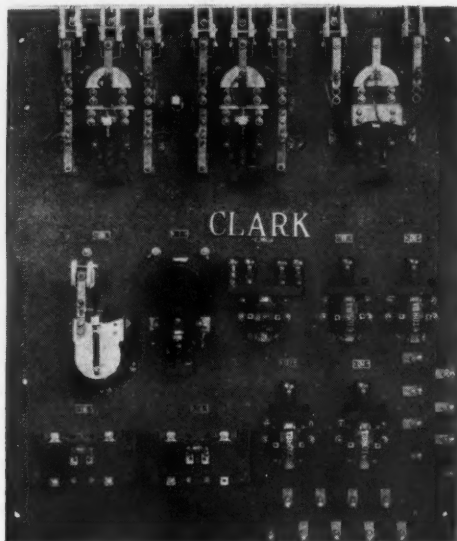
A five hp., 1750 r.p.m., 440 volt, splash-proof squirrel cage motor is mounted on the car at an angle of about 30 degrees from the vertical with the

shaft end down. This is called the knife motor. On its shaft is mounted a circular disc knife whose edge is very sharp and which is capable of cutting through comparatively thick sheets of cold uncured rubber, provided the speed is high and the knife is wet. A fine mist of water is automatically sprayed on the knife during the actual cutting. Satisfactory cutting requires the motor to get up to speed quickly before the knife touches the material.

As soon as the carriage moves forward far enough to be in synchronism with the belt, a rotating cam operates a limit type switch No. 3 (see diagram) which gives an impulse to both the knife motor and the car motor, starting them simultaneously in their correct direction. This causes the knife to cut through the rubber while the car is pulled across by the car motor as the whole assembly moves forward in synchronism with the conveyor. Near the end of the cutting stroke, another cam operated limit switch is actuated, which removes the 3 phase a.c. power from both motors

Cage Motors

Accurate braking torques obtained by applying direct current to terminals of squirrel cage motors.



SCHEMATIC WIRING diagram of both power and control circuits. No resistance is shown in the dynamic braking circuit of the 2 hp. motor since its internal resistance is approximately the correct value to give a saturating inrush of d.c. current on application of 115 volts.

CONTROL PANEL showing the arrangement of the contactors. The forward and reverse normally open 440 volt, 3 phase, contactors are mechanically interlocked and provide in the same unit normally closed d.c. contacts for the dynamic braking current. CR 2-3-4 are used as interlocks with the conveyor and transfer and are not shown in the schematic diagram.

and applies 115 volts d.c. to two leads of each motor. The d.c. current magnetizes the stator core which causes high current to be generated within the rotors. These rotor currents produce a strong magnetic field which opposes the rotation and brings the motors to a quick and accurate stop.

As soon as the motors reach standstill the d.c. power is removed by a simple time delay relay. This is possible because the stopping torque and the inertia always remain the same so that the time required to stop is also constant. As the motors remain stopped the carriage is pulled back by the conveyor driven chain to the starting position, where the chain link passes over the sprocket and starts the carriage forward again. As soon as the carriage again becomes synchronized with the conveyor, the starting cam switch starts both motors again, but this time in the opposite direction, causing the carriage to move back across the conveyor as the knife cuts back across the rubber. This is followed by the same stopping

sequence as before. The direction of the motor is determined by the position of the limit switches Nos. 1 and 2. This completes a cycle of operation. A complete cycle of cut-forward-stop and cut-reverse-stop is repeated about every 10 seconds continuously, depending upon the speed of the belt and the required length of tread.

In analyzing the power circuit, it will be seen from the diagram that the d.c. dynamic braking current is fed to the motor by normally closed contacts on the same contactors (F & R) that drive the motors. This is done in order to get the quickest possible application of d.c. to the motors after the a.c. is removed and at the same time providing mechanical interlocking between the a.c. and d.c. power. That is, the contactors (either F or R) merely drop out and remove the a.c. power with the normally-open contacts and apply the d.c. with its normally closed contacts in one motion. A dynamic braking contactor (1DB) removes the d.c. power in about one second which is ample time for both

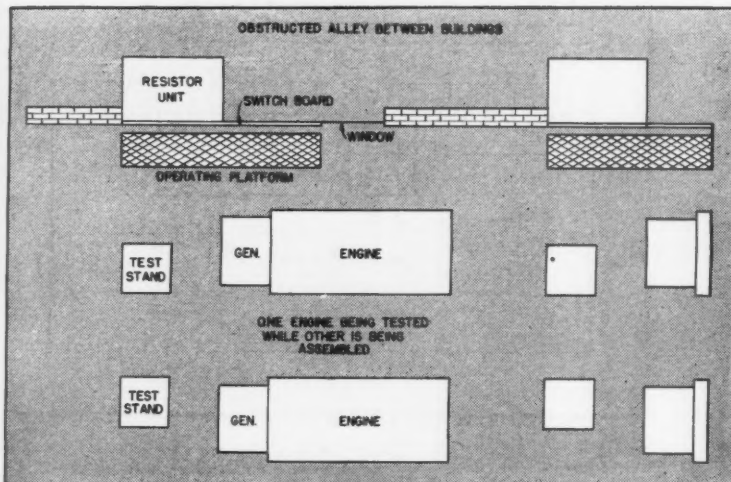
motors to come to a dead stop. The control coils are operated from the d.c. source which automatically stops the motors in case of failure of d.c. power. A low voltage relay coil (LVP) is connected to the a.c. power which locks out the d.c. control circuit in case of failure of the a.c. power.

It will be noted that one overload relay of each motor is in series with the d.c. braking circuit. This gives additional protection to the motors in case the time relay fails to operate, in which case (1DB) and (2DB) will be opened by the overload relay.

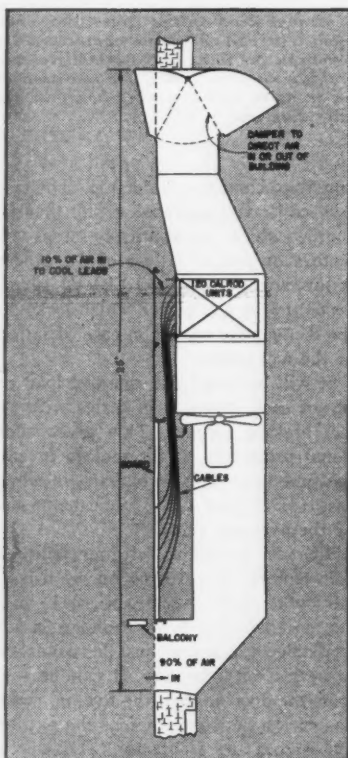
The d.c. resistance of four pole 440 volt motors above three hp. is usually too low to apply directly across 115 volts d.c. so that if a lower voltage is not available, a resistor must be connected in series with the d.c. It can be seen from the diagram that the five hp. motor has such a resistor, whereas the two hp. motor does not. Contactor (2DB) short circuits the resistor for normal running. The greatest average amount of braking

[Continued on page 142]

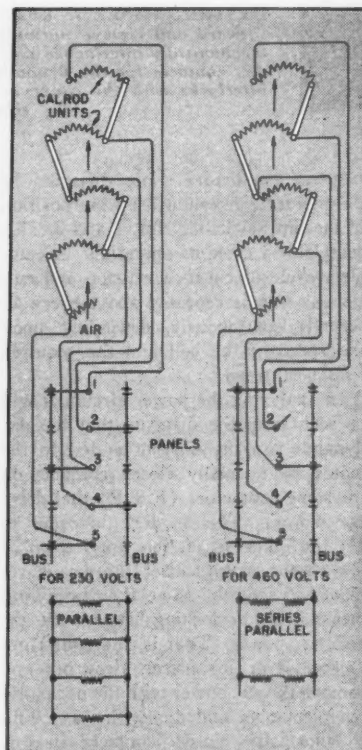
RESISTOR LOADING



FLOOR PLAN in front of one resistor unit. While one engine is under test, another is being assembled.



VENTILATION SYSTEM is shown in this typical cross-section. Heat may be directed inside.



CONNECTIONS between Calrod units and the switches on the board. Typical switch settings are shown.

Fan-cooled resistor unit assemblies replace water boxes for dissipating energy from diesel engine test stands.

By T. E. Johntz

*Engineering Department
General Electric Company
Chicago, Ill.*

IN a recent installation of three 960-kw. generator loading resistors to replace water boxes in the testing of engines at the St. Louis plant of the Busch-Sulzer Bros. Diesel Engine Company, space limitations and the need to conserve copper led to the use of the major part of three window spaces. Finned Calrod assemblies, complete with forced ventilation, switchgear and enclosures were tailored so that the front was flush with the inside of the wall, and the back four feet outside in the muffler-obstructed alley. The windows are 25 feet high and 17 feet wide and it was essential that light obstruction be as little as possible.

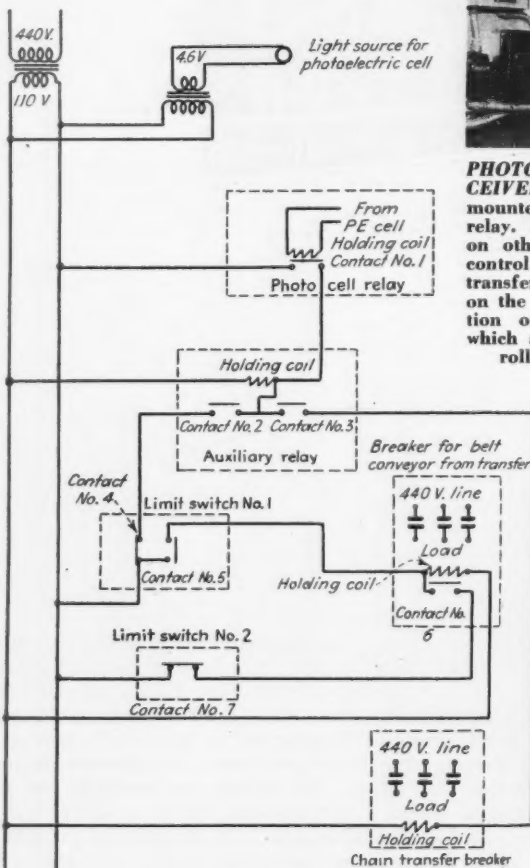
How the problem was worked out for one equipment is shown in the accompanying sketch. The engines are tested on assembly blocks directly in front of the loading units, two blocks being installed in each of the three stations. Three tests are going on at one time while three more engines are being assembled.

Each of the three 960-kw. resistors is made up of 120 finned Calrod "hairpins" rated 8 kw., 240 volts. The connectors are toward the front. They are mounted in a vertical air duct in ten horizontal rows of twelve each, staggered for maximum cooling. Individual resistors can be removed without disturbing the others.

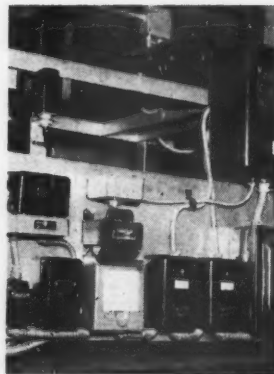
The space occupied by the 120 units is seven feet wide; three feet, eight inches deep; and three feet high. The terminals are connected down through a duct to the switchboard by 132 short cables.

Photoelectric Conveyor Control

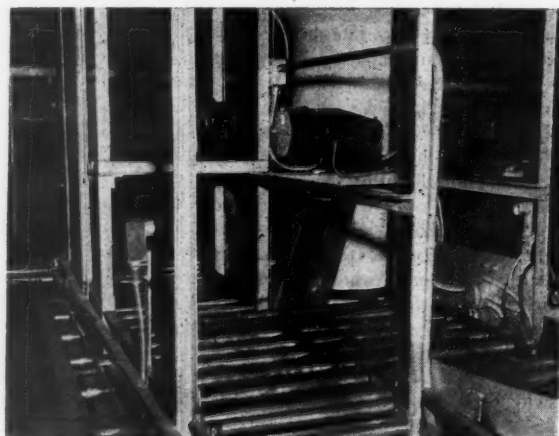
The electric eye polices a conveyor line, directing material to its correct terminus



WIRING DIAGRAM of a typical intersection. Norton Company's two mile of conveyor line, incorporates many such intersection points in addition to the several complicated elevator points. These latter entail a maze of electric eyes, limit switches and relays to provide for completely automatic, interlocked operation.



PHOTOELECTRIC CELL RECEIVER is in the center, mounted above the PE cell relay. Light source is at left on other side of line. The control for the complete transfer operation is located on the panel with the exception of the limit switches, which are placed among the rolls on the conveyor.



PHOTOELECTRIC LIGHT SOURCE can be seen at the left. The pallet carrying the material comes from around the bend and goes straight through if the light beam is uninterrupted. If however the light beam is broken, the transfer chains will immediately revolve and carry the pallet into unloading position for the other conveyor line.

THE electric eye has gained public acceptance via the door-opener at the theater, in the railroad station and in offices, hotels, restaurants and hospitals. Even home-owners have installed photoelectric control on garage doors. But more important is the industrial application of this unique little control mechanism. It counts, it identifies, it selects, it segregates. Its possibilities are many and varied.

The Norton Company of Worcester, Mass., manufacturers of abrasive wheels and grinders, do the vast majority of their material handling via belt and roller conveyor. All the abrasive wheel manufacturing areas are interconnected by approximately two miles of conveyors. The traffic cops on these highways are electric eyes. A complement of limit switches and relays are utilized to render full automatic control.

The conveyors operate on three different floor levels connected at several points by elevators. Several conveyors converge upon each elevator. Several emerge from the elevators at the different levels. At various points along the way, various conveyors will parallel and merge onto one line. At other points, a single conveyor will divide into two lines going to different departments. All this is completely automatic, with "ole brass buttons electric eye" blowing the whistle. *

The grinding wheels are carried on wooden platters called pallets. Each pallet is provided with a small round stick about two feet long, which when placed vertical on the pallet, interrupts the light beam of the photoelectric cell. Thus when an operator places material

[Continued on Page 85]

Lighting

WARTIME

and POSTWAR

TWO urgent problems stand out in the lighting industry as we begin what is probably the last winter of coastal dimouts and lighting conservation. First, there is still a job to be done in stepping up production and other essential lighting to the most effective levels and quality consistent with material conservation. To carry out the responsibility requires well designed general lighting, effective use of local lighting, relocation of existing equipment and ingenious use of sources and luminaires for special seeing tasks. But most of all it requires skill and experience in the use of lighting tools, a ready knowledge of the limitation rules and priority procedure and a strong confidence in the value of lighting to speed victory. For lighting today takes double selling, to sell management on its economic worth and to sell war agencies on its essentiality in terms of the necessary critical materials.

Our second responsibility is to plan for tomorrow, to line up our sights on prospects and markets, to study materials and methods for the time when limitations shall be lifted and the lights go on again. The course of lighting postwar promises to exercise a profound effect on the economic and social life of America in the years to come.

Rating Essential Lighting



Controlled Production of the lighting fixture industry, from raw materials through sale and delivery is the job of the Lighting and Fixtures Section. This article describes its operation and details the methods to use for obtaining ratings for essential wartime lighting.

**By Berlon C. Cooper, Chief, Lighting & Fixtures Section,
Building Materials Division
War Production Board**

THE lighting industry in 1939, a peacetime industry, and in 1943 as a wartime industry gives a striking comparison. The 1939 U. S. Census Bureau report indicates that the lighting industry in that year did a total business of a little more than \$200,000,000. This volume may be considered as covering normal peacetime manufacture and sales. It included equipment designed for use with incandescent, mercury vapor and fluorescent lamp sources, for use in industrial and commercial areas, residential equipment of the permanently installed type as well as portable lamps and shades as sponsored by the "Better Light—Better Sight" program, lighting for stage and theatre, churches and institutions, street and highway, protective and spectacular, as well as the limited volume of marine, aircraft and airport lighting equipment being produced in that year.

Present tabulations made by the War Production Board from information filed by manufacturers of lighting equipment under Production Requirements Plan and Controlled Materials Plan and from programs established by the various Claimant Agencies, indicate that the lighting industry in 1943 will also reach a volume in excess of \$200,000,000.

This 1943 production differs from the 1939 production, however, in the types and classifications of equipment being manufactured, since only lighting equipment necessary to the war program is now permitted. Such equipment includes primarily marine, aircraft, airport, industrial, protective, and essential commercial lighting for offices and drafting rooms.

The scope of the field of illumination is of necessity restricted or limited during wartime. Exclusive of direct military lighting requirements such as for aircraft, for essential airports, for use on board ship, for Army cantonments and facilities, and for blackout and

dimout lighting, lighting requirements generally are limited to essential areas in industrial plants engaged in war production and administration and essential civilian activities.

Since the establishment of the Lend-Lease program, American industry has been gearing itself to all-out war production. Industrial plants engaged in peace-time manufacturing have been busily converting their facilities to the production of weapons of war and material needed by the military.

In order to meet the varied demands of the war program, it was necessary to establish new facilities for the production of many items. Such facilities have accounted for the large construction program which is now being curtailed. The conversion of existing plant facilities to the production of war material has necessitated the re-lighting of many plants not having adequate lighting facilities for such work and accounts for the program of relighting or conversion lighting which has been underway for over two years. Since the availability of labor and of raw material is now limited and new construction is being curtailed, it becomes necessary to develop existing facilities to provide maximum production and maximum efficiency. And it is through the development of these existing facilities that greater production may be realized.

The war production program has now been under way for sufficient time so that the programs for the production of tanks, planes, ships, ordnance materials and other military requirements have reached a fair point of stabilization geared to the availability of raw materials and labor. The logical next step, therefore, is to increase plant efficiency, decrease rejects and increase production in the existing facilities.

Limitation orders have been issued which control the

manufacture and sale of lighting equipment. Conservation of critical materials has been achieved through these orders, thereby diverting such materials directly to war plants producing tanks, planes, guns and ships. These orders insure the maximum amount of illumination with the minimum use of critical metals.

Illuminating engineers, manufacturers, distributors, contractors and industrial plant owners and engineers want to know the over-all policy of the War Production Board relating to the problem of *who* can do relighting and *when* and *where* they can do relighting. It should be understood, however, that in wartime any policy established with relation to the use of critical materials such as is used in the manufacture of lighting equipment is subject to constant change based on the necessary changes of the overall military program. Comments made here must of necessity, therefore, reflect only the current policy and it should be understood that any change in military strategy may have far reaching effects on any program which makes use of the same critical materials.

It is recognized by those in the War Production Board responsible for the production and control of the use of lighting equipment that adequate lighting means increased production, better workmanship, reduced spoilage due to defects in finished products, reduction in accidents and less absenteeism due to the ill effects of poor or inadequate lighting. In view of the necessity to curtail the establishing of new facilities, it is further recognized that better lighting should be utilized where required in order to increase production to the fullest extent possible. To achieve top production, it is necessary to keep plants working around the clock. With more and more of the young men and women going into the armed services, it is also recognized that more light is required for equal seeing ability by the growing proportion of older workers.

It is considered that any plant whose major facilities are devoted to war work should have adequate lighting to carry on its work. The amount of light which is considered to be adequate will, of course, depend on the type of work being done in each area or department of a specific plant. The policy of the War Production Board where the need is established, is to permit installations which will produce maximum average intensity not to exceed the minimum foot-candle intensities of the "American Recommended Practice of Industrial Lighting" approved by the American Standards Association and sponsored by the Illuminating Engineering Society for illumination design.

Certain industries in which the production program calls for the use of all the facilities of the industry are considered to have first or top priorities for lighting equipment, since it is important to get maximum production from each plant in order to meet the requirements of that program. Plants engaged in the manufacture of airplanes are typical examples.

In certain other industries where a plant may be engaged 100 percent in war work but only on a one shift basis, and where the industry's facilities far exceed the requirements for the product, priority assistance for the purchase of lighting equipment may be denied with concurrence of the agency or agencies placing orders with the plant making application for priority assistance. It is considered in a case of this kind that the use of critical material involved in a relighting program would not be in the interest of conservation and would not help win the war. This position is tenable even though the plant is 100 percent on war work, since adequate facilities exist in that industry to meet the requirements of the war program.

It is vitally important to realize that there are bound to be changes in the requirements of an Army at war. These changes will and must take place. Sometimes our enemy dictates them, sometimes our Army dictates them because it sees a change that will enormously strengthen the fighting power of our men. Such changes may have far reaching effects upon certain industries by stopping production on certain goods and creating idle plants in such industries, or by stepping up production in other industries and taxing their facilities. It should be kept in mind that no war program can be static for very long, and that it is necessary to coordinate all available information regarding any industry in giving considera-

WPB FORMS TO BE USED FOR FILING FOR PREFERENCE ASSISTANCE

WPB-541—formerly PD-1A—For lighting equipment when no construction is involved.

WPB-617—formerly PD-200—To be used when construction is involved (L-41 controls.)

WPB-547—Covering inventories of lighting equipment for resale (filed by wholesalers).

CMP Reg. 5 (or 5-A)—MRO (as "minor capital additions")

Establishments certify rating for lighting equipment as minor capital additions or maintenance, repair or operating supplies. Manufacturers listed on

- Schedule I—assigned AA-1 rating
- Schedule II—assigned AA-2 rating
- All other businesses assigned AA-5 rating

(All the above are subject to quantity restrictions and limitations of CMP Regulations 5 or 5-A.)

Installation of fixtures subject to Conservation Order L-41 if construction is involved.

SUPPLEMENTARY LIGHTING AND ELECTRICAL DATA
to be furnished with
APPLICATIONS FOR PREFERENCE RATINGS ON LIGHTING EQUIPMENT

Note: If Application for Preference Rating lists materials for more than one area, furnish the following information for each area.

A. DESCRIPTION OF EACH AREA TO BE LIGHTED

1. Area identification (use name or number) _____
2. Physical characteristics:
 - (a) Dimensions: Width _____ ft. Length _____ ft. Area _____ Sq. Ft.
 - (b) Ceiling Height: _____ ft.
 - (c) Reflection factor: (1) Ceiling: Light ☐ Medium ☐ Dark ☐
(2) Side Walls: Light ☐ Medium ☐ Dark ☐
3. Types of machines and/or equipment used in area: _____
4. Degree of precision of workmanship required: Rough ☐ Medium ☐ Fine ☐ Extra Fine ☐
5. Electrical wiring in each area:
 - (a) Type current: A.C. ☐ D.C. ☐ Frequency: _____ cycles
 - *(b) Type circuit: Phase _____ Wire _____ Secondary Voltage: _____ Volts
 - (c) Number of ceiling lighting outlets: _____
 - (d) Number of branch lighting outlets: _____
 - *(e) Number of lighting branch circuits: _____
 - *(f) Average length of branch circuit runs (panel to load center): _____
 - *(g) Wire size in branch circuits: _____ B&S Ga. Conduit size: _____
 - *(h) Length of distribution feeders from main to branch circuit panels _____ ft.
 - *(i) Distribution feeder wire size: _____ B&S Ga. Conduit size: _____
 - *(j) Maximum permissible (NEC) load for area on present wiring: _____ watts.

B. EXISTING LIGHTING - EACH AREA

1. Type of lighting: Direct ☐ Semi-direct ☐ Semi-indirect ☐ Indirect ☐
Incandescent ☐ Fluorescent ☐ Mercury Vapor ☐ Other ☐
3. Existing lighting fixtures:
 - *(a) Manufacturer's name _____
 - *(b) Catalog No(s) _____
 - (c) Description _____
4. Quantity of each type lighting fixture: _____
5. Number of lamps per fixture _____ Total quantity of lamps: _____
 - (a) Individual lamp wattage rating: _____ watts
 - *(b) Lamp bulb type designation: _____ Rated voltage: _____ Volts
6. Total lighting load: (a) Lamps _____ Watts
(b) Auxiliaries _____ Watts
(c) Total _____ Watts
7. Mounting height (floor to bottom of fixture): _____ ft.

tion to application for priority assistance for the purchase of capital goods such as lighting fixtures.

Many applications for preference ratings covering lighting equipment present a difficult problem in deciding whether or not priority assistance should be given. In such cases, it is the policy of the Lighting and Fixtures Section, Building Materials Division, War Production Board, to develop all the facts relating to the case. It is desirable to have the same information regarding the area or areas to be relighted that the illuminating engineer required to make a recommendation covering the relighting. Such information is obtained through the use of a supplementary lighting and electrical data form.

Information called for on this form includes the physical dimensions of the building or area to be relighted, color of ceiling and side walls, type of work to be performed in the area, a listing of the existing wiring conditions, a description of the present lighting equipment including the number and types of units involved, and a description of the proposed lighting including the number and type of lighting fixtures involved. With this information, an analysis of the present and proposed lighting can be simply evolved and the proposed average

intensity to be obtained from the new lighting equipment can be checked against the American Standard Association's recommended foot-candle intensities for the type of work to be performed. If increased production is essential and if the lighting analysis indicates first, that the present lighting is inadequate; second, that the proposed lighting is in line with recommended intensities; and third, that the type of lighting equipment which is proposed does not use excessive quantities of critical materials, then an adequate preference rating is recommended in line with the urgency for the immediate installation of such equipment.

The question of *where* relighting may be done may next be reviewed. It is considered that any area in which essential war work is carried on should have adequate illumination to perform such tasks as are to be done in such areas. Where manufacturing, assembling or other industrial functions are performed and where present intensities are inadequate for the type of work being done, it is considered that it would be in the interest of the war program to install adequate lighting, provided the system of lighting selected is not wasteful of critical materials. It is also considered that other related areas such as drafting rooms, molding lofts and

8. Spacing of fixtures: _____ ft. x _____ ft.
9. *Present light intensity on working plane: _____ footcandles
 (a) Measured ☐
 (b) Estimated ☐
10. *Present Cleaning and maintenance schedule (describe) _____
11. Present condition of fixtures now in use _____
- C. PROPOSED NEW LIGHTING - EACH AREA**
1. Type of lighting: Direct ☐ Semi-direct ☐ Semi-indirect ☐ Indirect ☐
2. Light source: Incandescent ☐ Fluorescent ☐ Mercury Vapor ☐ Other ☐
3. Proposed lighting fixtures:
 (a) Manufacturer's name _____
 (b) Catalog No(s) _____
 (c) Description _____
4. Quantity of each type lighting fixture: _____
5. Number of lamps per fixture: _____ Total quantity of lamps: _____
 (a) Individual lamp wattage ratings _____ watts
 * (b) Lamp bulb type designation: _____ Rated Voltage: _____ Volts
6. Total Lighting load: (a) Lamps _____ watts
 (b) Auxiliaries _____ watts
 (c) Total _____ watts
7. Mounting height (floor to bottom of fixture): _____ ft.
8. Spacing of fixtures: _____ ft. x _____ ft.
9. Proposed new lighting fixtures to be used for:
 (a) General Illumination ☐
 (b) Localized-general illumination ☐ *(Furnish Sketch)
 (c) Localized Illumination ☐
10. *Estimated light intensity on working plane: _____ footcandles
11. Are new lighting fixtures to be mounted on present outlets: Yes ☐ No ☐
 (a) Will preference assistance be required on related materials: Yes ☐ No ☐
 (b) Has application for preference assistance been filed for any other related materials: Yes ☐ No ☐ When: _____
 (c) Describe type of related materials briefly _____

B. OTHER PERTINENT DATA

Furnish any other information relating to the lighting for this area which you think should be given consideration. (Use additional sheet if necessary)

*Items thus marked need not be answered when application for preference assistance is for ten (10) or less lighting fixtures.

office areas in which critical seeing problems are involved, should be provided with adequate lighting and that such areas should receive the same consideration and treatment as accorded to industrial areas.

An establishment requiring priority assistance for the purchase of lighting fixtures may apply through various procedures.

1. Form WPB-617—Application for priority assistance is made on this form when construction is involved. This form is used to obtain permission to begin construction under the terms of Conservation Order L-41 and to obtain priority assistance. These forms should be filed with the nearest Field Office of the War Production Board.

2. Form WPB-541—Application for priority assistance is made on this form when no construction is involved and priority assistance is required on lighting equipment only. All applications made on this form should be filed with the nearest War Production Board Field Office. Applications involving less than \$500 in value are processed in the field and regional offices of the War Production Board. Applications involving more than \$500 in value are forwarded to War Production Board, Washington, D. C., for processing.

3. Form WPB-547—Application for priority assist-

ance is made on this form by wholesalers or distributors to obtain inventory for resale. These applications should be sent to the War Production Board, Washington, D. C., Reference PD-1X.

4. Lighting fixtures ordered as "minor capital additions" under CMP Regulations No. 5 or 5-A are assigned preference ratings by the purchaser on "certification" as outlined in the Regulations. The buyer, however, must observe all governing quantity restrictions and limitations of CMP Regulations 5 or 5-A.

It seems pertinent to me, in summarizing, to point out that we must face frankly the fact that the fields of opportunity in lighting are restricted, due to the curtailment of the facilities or new construction program, and due to the elimination of certain types of normal peacetime lighting fixtures or equipment. On the other hand, the total dollar value of lighting equipment remains practically the same as for 1939, one of the fairly normal pre-war years. Those concerned with lighting installations can do much to serve the industry and the country by keeping in close touch with the various orders and regulations governing the manufacture, sale and delivery of the various types of lighting equipment, so that they may intelligently advise architects, engineers and plant owners with respect to lighting.

Design Standards of

UNDER the direction and control of the War Production Board, lighting standards in manufacture and installation, are held to strict "bare bones" policy. At the manufacturing level several Limitation Orders operate to control weights of metal.

Restrictions are placed on the manufacture of lighting fixtures and equipment by various "L" and "M" orders, with which most of you are familiar. The orders include the following:

- L-29 Electric Signs
- L-33 Portable Lamps
- L-78 Fluorescent Lighting Fixtures
- L-168 Blackout and Dimout Lighting Equipment
- L-212 Incandescent Lighting Fixtures
- L-235 Airport Lighting Equipment
- L-277 Wiring Devices
- M-1 Aluminum
- M-9-c Copper
- M-11-b Zinc
- M-126 Steel

Limitation Order L-78 generally restricts the manufacture of fluorescent lighting fixtures to industrial type equipment and limits the amount of critical materials which may be used in fixtures of different sizes. Sale and delivery is restricted to orders or contracts bearing a preference rating of A-1-j or higher with some exceptions. Inventory fixtures manufactured on or before June 1, 1942, may be sold on a preference rating of B-2 or better. Component parts may be sold for maintenance and repair without a rating, and fluorescent lighting fixtures may be sold to government departments or agencies such as the Maritime Commission, Navy Department, War Department, Metals Reserve Company, War Shipping Administration and Reconstruction Finance Corporation without ratings.

Fluorescent lighting fixtures using lamps rated 30 watts and less and cold cathode lighting equipment may be sold without a rating provided such fixtures were manufactured or assembled from materials which had been put in process on or before April 20, 1942.

Limitation Order L-212 restricts the manufacture, and sale and delivery of incandescent lighting fixtures as defined in that order. For purposes of simplicity, incandescent lighting fixtures have been divided into three groups in this order, namely, industrial, residential and utility incandescent lighting fixtures. Sheet metal gauge restrictions are established covering industrial incandescent lighting fixture, and those permitted to be manufactured are limited to three specific types—the shade holder, the solid neck and the heavy duty or threaded neck types. Residential incandescent lighting fixtures are restricted to the use of not more than six ounces of ferrous metal. Conservation of ferrous metal is achieved in the manufacture of utility incandescent lighting fixtures by establishing a maximum size for globe holders and canopies, and prohibiting the use of metal in louvers, shields, baffles, or metal reflectors in such fixtures. Re-

strictions are established in this order on sale and delivery of industrial and utility incandescent lighting fixtures to orders or contracts bearing a preference rating of A-1-j or better, except that fixtures manufactured and assembled prior to the issuance of the order (March 31, 1942) may be sold without a rating. No sales restrictions are imposed on residential fixtures manufactured in conformity with the manufacturing restrictions of this order.

In the application of lighting WPB has issued the "Design Guide for Interior Electric Lighting and Wiring for Wartime Construction" as a supplement to the "Critical Construction Materials Design Guide," as follows:

DESIGN GUIDE

For Interior Electric Lighting and Wiring for Wartime Construction

In the interest of conservation, but without sacrifice of adequate seeing conditions, interior lighting installations shall be incandescent, high-intensity mercury (mercury H) or fluorescent light sources in accordance with the following:

1. Fluorescent lighting may be used only as follows:

a. In production areas only, where fixtures are mounted not higher than 20 feet above the general working plane and where, as an alternate or an addition to incandescent lighting, fluorescent installation is deemed advantageous for exacting visual tasks in the following categories of skilled operations:

(1) Assembly, inspection and calibration of instruments, or precision equipment.

(2) Operation of fine weaving and cutting machines.

(3) Precision tool and metal work of fine detail.

(4) Other factory production work with tools or machines, including setting and repair of the machines and inspection incident to such manufacturing processes.

(5) Minute color, contour or shade discrimination, or color matching.

(6) Floor drafting or similar work in such areas as molding lofts.

b. In offices or other rooms where, because of ceiling conditions or excessive radiant heat, incandescent lighting will be unsatisfactory for such tasks as accounting and auditing, business machine operations and tabulations and drafting and designing.

c. In buildings operating mainly for the war effort and which are supplied in whole or in part from an isolated electric generating plant where installation of fluorescent lighting for essential higher intensities will immediately prevent an addition to such generating capacity.

d. In buildings being converted, altered or modernized for war production and which would have to be substantially rewired if incandescent lighting were installed to obtain the necessary higher intensities.

2. High-intensity mercury lighting (mercury H) may be used only where it is deemed advantageous for such areas and purposes as: high-mounting heights referred to in Paragraph 3; plating and pickling rooms and such areas where other light sources would be affected by fumes, or where color correction is necessary with incandescent lighting.

Wartime Lighting

3. For production areas where fixture mounting heights are in excess of 20 feet above the working plane, the lighting system shall be incandescent or a combination of incandescent and high-intensity mercury (mercury H) units, except where work is to be performed on large specular reflecting surfaces such as airplane wings, fluorescent lighting may be employed.

4. Incandescent lighting shall be used in all areas and for all purposes except where, as permitted herein, fluorescent lighting or high-intensity mercury (mercury H) lighting may be used either as an alternate for incandescent lighting or in combination with it.

5. All lighting fixtures and accessories shall be constructed in accordance with the applicable L and M orders of WPB.

6. The maximum average lighting intensities in service shall not exceed the minimum foot-candles recommended by the American Recommended Practice of Industrial Lighting, 1942, issued by the Illuminating Engineering Society and approved by the American Standards Association. The attached supplementary table, which is consistent with the IES publication above, may be taken as illustrative of maximum intensities for the more prominent wartime seeing tasks.

7. Wherever possible, appropriate colors (lighter shades) of non-critical paints or other finishing materials on walls, ceilings, floors, and machines, should be used to improve reflecting surfaces and reduce the wattage of lighting systems.

8. Electric wiring and conduit systems for interior lighting installations shall, in general, conform to the following:

a. Such systems shall be designed to utilize minimum amounts of critical materials, such as copper, rubber and steel, without provisions for future extensions, making maximum use throughout of the common neutral wire in both alternating and direct current systems, using as high standard voltage as is consistent with the design of the installation.

b. All wiring shall be open wiring on insulators, concealed knob and tube work, or other types of wiring approved for wartime construction in accordance with War Production Board Limitation Order L-225 or other applicable WPB orders or directives.

c. Rubber insulation is permitted only on electrical conductors in buildings and, where necessary, in underground installations, but not for open wiring in dry locations or for solidly grounded conductors. The grades of the insulation used shall be in conformity with those listed in the Table set forth in War Production Board Order M-15-B-1, List 27, Items (1) to (3) (c), inclusive.

d. Conductor sizes, except as may be necessary to secure the proper operating voltage at the lamps, shall be the minimum permitted by the 1940 National Electrical Code, with amendments thereto issued by the Emergency Committee of the National Fire Protection Association. Proper operating lamp voltage shall, as far as possible, be obtained by selecting the proper supply voltage rather than by increasing the conductor sizes.

SUPPLEMENTARY TABLE OF INTENSITIES

AIRPLANE MANUFACTURING

Stock Parts—	
Production	35
Inspection	A*
P Manufacturing—	
Welding, Drilling, Riveting and Screw Fastening ..	30
Spray Booths ..	30
Sheet Aluminum Layout and Template Work;	
Shaping and Smoothing of Small Parts for Fuse-	

lage, Wing Sections, Cowling, etc.....	A*
Sub-assembly—	
Landing Gear, Fuselage, Wing Sections, Cowling	
and other large Units.....	30
Final Assembly—	
Placing of Motors, Propellers, Wing Sections and	
Landing Gear; Mounting of Guns and other	
large Equipment	30
Inspection of Assembled Ship and its equipment..	A*
Machine Tool Repairs.....	A*

ARTILLERY MANUFACTURING

Forging and Casting of Gun Barrels and Mounts....	10
Machining and Grinding of Gun Barrels, Breeches,	
Mounts and Carriages.....	30
Measuring and Testing of Parts; Barrel Boring; Ma-	
chining and Assembly of Range Adjusters, and Fir-	
ing Mechanisms	A*
General Assembly	35-50

TANK MANUFACTURING

Assembly Line	40-50
Frame Assembly	20
Body Manufacturing—	
Parts	20
Assembly	20
Finishing and Inspecting.....	A*

CONSTRUCTION—GENERAL

Excavation	2
Exterior	5
Indoor	10

EXPLOSIVES

Hand Furnaces, Boiling Tanks, Stationary Driers, Sta-	
tionary and Gravity Crystallizers.....	5
Mechanical Furnaces, Generators and Stills, Mechanical	
Driers, Evaporators, Filtration, Mechanical Crystal-	
lizers	10
Tanks for Cooking, Extractors, Percolators, Nitrators.	15

PRECISION WAR EQUIPMENT

Assembly and Adjustment of Range Finders, Binocu-	
lars, Periscopes, Timing Equipment, Gun Sights,	
Electronic Devices, Torpedo Mechanisms, etc.....	A*

SHELL LOADING PLANTS

Fuse and Booster Manufacturing	50
Inspecting, Cleaning and Spraying of Shell Forging...	30
Loading of Shells, Bombs, Mines and Depth Charges—	
Hand	A*
Automatic	30
Cleaning and Inspection.....	30
Assembly of Shells, Bombs, Mines and Depth Charges.	30-40
Packing and Boxing-Storage.....	10

SHIPYARDS

General	5
Ways and Fabricating Areas.....	10

A* These are critical, sustained seeing tasks, frequently occurring in small areas or rooms, and call for lighting intensities frequently as high as 50-100 foot-candles. To conserve critical materials as well as effect other economies, a combination of general illumination (20 foot-candles) with supplementary or localized lighting directly over working surfaces will generally suffice. Good results have been achieved by hanging standard industrial type fixtures 3 to 5 feet directly over the benches or objects, where practicable, or attaching portable type fixtures of lower wattage much closer to the working surfaces.

Essential Lighting

PRESENT day lighting, like all other activities, is keyed to the war effort. Lighting manufacturers, under guidance of government limitation and restrictive orders, are using "essentiality" as a yardstick in design and production. Wholesalers, engineers and contractors are following suit in the sale, distribution, recommendation and installation of lighting equipment. By following this pattern, critical materials and equipment are diverted into channels where they are most needed and where they will do the most good from the standpoint of the prosecution of a victorious war.

The field of wartime lighting applications has shrunk considerably from that of peace time. Today, essentiality is the first hurdle that a successful application for a lighting installation must clear. If WPB makes a positive decision, then the merits of the existing and recommended schemes are carefully weighed. Much time, effort and disappointment could be averted if the contractor had a clear conception of just what constitutes "essential lighting."

To be considered essential, recommended lighting systems must contribute to the war effort—that is they must be installed in some building or industry where the work is closely tied-in with production of war material. Also, such lighting must aid production through reduction of spoilage and errors; and through higher quality workmanship. This eliminates most commercial lighting projects. Permissible lighting then falls into the following general categories which will be used for the following discussion.

1. Production Lighting
2. Inspection Lighting

3. Protective Lighting
4. Safety Lighting
5. Lighting for National Defense Buildings
6. Essential Civilian Lighting

Let's consider each of these groups in a more detailed manner.

PRODUCTION LIGHTING

There is still an enormous job to be done in providing adequate and proper production lighting in the hundreds and thousands of small subcontracting plants engaged in war production. The large newly constructed plants already have the best that lighting engineers could design—a positive testimony that the government agencies consider good lighting a key to efficient war production. Lighting of this type falls into two major groups—general illumination and supplementary localized lighting.

General Lighting—For many industrial processes, a good general lighting system will provide adequate illumination for the task at hand. Whether or not it will do the whole job depends upon a study of the actual seeing tasks involved in each individual case. An adequate lighting system may involve a complete new installation, rehabilitation of the existing system with new equipment, or simply additions. In any case, the solution which gives the requisite illumination with the least amount of critical materials or equipment will get WPB approval. Lighting may be of the fluorescent, incandescent or mercury type, depending upon the visual conditions involved.

Local Lighting—Many industrial operations cannot



GENERAL LIGHTING with continuous fluorescent troughs provides substantial illumination for precision machine tool work in this plant.



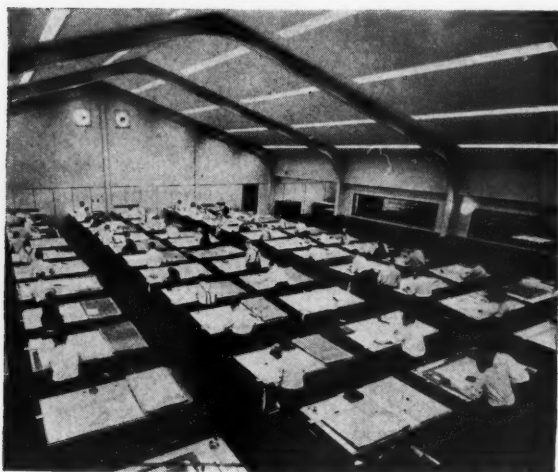
LOCALIZED LIGHTING unit gives the added punch of light needed for the employee to closely follow this grinding operation.

be adequately illuminated without the aid of local lighting units. This is particularly true where shadows from machine parts and work tend to darken critical seeing areas and a good vertical lighting component is necessary. Local light sources may be individually mounted fluorescent units or projector type incandescent units to direct light at the localized work area. Choice of the type of unit depends upon the work involved—low brightness, large area, fluorescent units being recommended for highly specular surfaces. Shop conditions will determine whether such local lighting units should be ceiling or machine mounted, or on movable floor pedestals.

INSPECTION LIGHTING

Never before has inspection lighting played such a prominent part in the industrial picture. War demands quality and quantity production. A defective part in an airplane motor may mean the total loss of a plane and its crew. To do an efficient job, the inspector must be provided with the proper type of high-intensity illumination. Eye fatigue induced by poor lighting of the wrong type can become an effective internal saboteur.

Most inspection lighting is of the supplementary or localized type with units mounted close to the working plane to produce the ultra high intensities required. Whether the units are of the fluorescent, incandescent or mercury type depends upon the material being inspected. Some materials and metals can be inspected best under incandescent or mercury light, others under fluorescent. A careful study of the problem at hand should be made before any system is recommended and submitted for WPB approval.



DRAFTING ROOMS must have the best of lighting. Built-in fluorescent troughs provide 35 to 40 foot-candles on the boards in this room.

PROTECTIVE LIGHTING

Conceived by War and dedicated to the crippling or destruction of our war production machine might be the code of enemy saboteurs. A saboteur likes shadows and dark areas and will wilt under the beams of a protective lighting system. To safeguard the plant, personnel and product, American industry has gone in heavily for lighting for protective purposes. Systems of this type fall into three general categories—fence lighting, area (yard) lighting and building lighting. Their principal purpose is to silhouette anyone approaching the plant from any direction and prevent pools of shadows within the grounds.

Fence Lighting—A well illuminated fence line is the first line of defense against a lurking saboteur. It enables the patrolling watchman to spot anyone loitering near or trying to climb over the plant enclosure. The equipment used generally consists of open type floodlights, open reflector fence lights and the street-light type of unit with glass refracting globes. Series circuits are being employed extensively to save copper.

Area or Yard Lighting — A plant's second line of defense is a good yard lighting system. If a saboteur should succeed in scaling the fence, he can then be spotted crossing the area. Material dumps, outbuildings and open storage areas should also be carefully illuminated to eliminate protective pockets of darkness to shield would-be saboteurs. For this purpose, flood-lighting units, either pole or building mounted are employed.

Building Lighting — Clearly illuminated building exteriors provide the third line of defense against sabo-



HIGH INTENSITY MERCURY units satisfy the illumination requirements in the high bay area in this plant. Units are mounted 28 feet above the floor and 32 feet apart.

teurs. All building projections, offsets, and lean-to structures as well as outdoor substations and transformer mats should be carefully lighted. Anyone bent on destruction will shun a well lighted area. Units used for this type of lighting include ordinary RLM fixtures on goosenecks, open or enclosed type of floodlights as well as units with refracting glass globes. Although, for conservation, the number of units used should be kept to a minimum, the design should eliminate any dark or "blind" spots along the building walls within 10 feet of the ground.

SAFETY LIGHTING

Also included in the group of lighting systems considered essential is that of safety lighting. Taken in the broad sense, all production lighting contributes to the safety of the employee—general, localized, supplementary systems and the new science of three dimensional seeing (the use of light and paint of contrasting colors to accentuate critical working areas on machines).

That phase of safety lighting discussed here is not directly concerned with production, but with the provision of minimum lighting during emergencies and possible blackout periods. Briefly, it may be divided into the following groups: night lighting, emergency lighting systems, blackout and dimout lighting, obstruction lighting, street lighting and airport lighting.

Emergency Lighting and night lighting systems are closely related. Before the war demanded around the clock operation of plants, very little was done about separate lighting systems for use during an emergency power failure or blackout. Systems of this type employ a minimum number of low candle power units, usually located in plant aisles and passageways to provide illum-

ination if the general lighting system is out or for orderly removal of personnel to shelters during a blackout or air raid. Systems of this type are usually fed from separate utility services, isolated plant generating units, or storage battery sets.

Blackout Lighting—Systems of blackout lighting are generally used in plants where total obscuration of production lighting is not practical. Here again, the units are fed by services separate from the conventional system. Fixtures are of a special design having a minimum of $1\frac{1}{2}$ and a maximum of 3 initial lumens to the light-adapted eye. Official specifications for blackout lighting, developed by the Engineer Board, research agency for the Corps of Engineers, U. S. Army will be found on pages 45 to 48, July 1942 issue, *Electrical Contracting*. Alteration of commercial show window and advertising lighting for blackout control is another field to explore.

Obstruction Lighting—Air Corps training centers have sprung up throughout the country as a result of the wartime tempo of training pilots. Many are in areas that before had no recognized airports. Obstruction lighting for buildings, chimneys, tanks, etc. are a necessary precaution to assure the safety of the trainees during night-time flying. Generally, specially designed obstruction units are used for this purpose. In some instances floodlights are used to illuminate high chimneys or stacks.

Street Lighting—This is a subject in itself, hence will not be discussed in detail at this time. There are, however, many opportunities of preparing street lighting systems for dimout or blackout operation. Total elimination is not recommended since the safety of the civilians must be considered.



TEXTILE MILLS are rapidly turning to fluorescent general lighting to provide the high-intensity quality illumination needed for the exacting seeing tasks involved in such operations.



PROTECTIVE LIGHTING of the fence-line, yard and exterior building type keeps prospective saboteurs away from this manufacturing plant as well as facilitating night-time operations.

Airport Lighting—This subject is also too broad for detailed discussion here. It is sufficient to point out that contractors are learning more about this type of lighting each day and it opens a wide field for postwar consideration. With the advances made in aviation and the prospective growth of civilian air transport, elaborate airport lighting and control systems will appear. Systems of this type include obstruction and boundary lighting, runway floodlighting, traffic control lighting and circuits, hangar and administration building lighting.

NATIONAL DEFENSE BUILDINGS

National defense buildings, of course, get top ratings with war plants in securing materials and equipment for lighting. Buildings of this type fall naturally into two categories.

Living Accommodations—These units include barracks, mess halls, recreational centers, post exchanges and so on.

Operational Units—These buildings include such functional units as shops, training centers, administrative buildings, hangars, laundries, power houses and so on.

The first group embodies conventional everyday lighting systems. In the latter group, however, some highly specialized lighting problems present themselves—particularly in specific training centers.

ESSENTIAL CIVILIAN LIGHTING

Civilian lighting needs, to get any priority rating at all, must be highly essential and contribute to the health and welfare of the public. The more important civilian activities might fall into the following categories:

Utilities—Gas and electric companies generating and distributing current, water works, radio and telephone facilities, newspapers.

Transportation—Railroad and transportation stations, repair shops and garages.

Food Production—Farms, packing houses, food plants and distribution centers; farm implement plants.

Health Institutions—Hospitals, clinics, etc.

Office Buildings—Offices housing personnel whose activities are considered essential to the prosecution of the war effort.

Service Activities—Laundries; dairies; household appliance repair shops; electrical, plumbing, heating and ventilating service shops; and so on.

Municipal Services—Police and fire departments.

Before applications for increased or new lighting in these instances will be processed, however, a definite need must be proved.

IN CONCLUSION

With the above resumé as a background to the types of lighting that are permissible under wartime restrictions, contractors can launch a campaign of better lighting for industry—particularly the smaller plants. WPB recognizes the need for good lighting and is promoting it; contractors know the need. It is up to them to sell management and to clearly outline the proposed work for priority assistance. All will profit—increased production and higher quality workmanship will please both WPB and the management; the boost in employee morale will be an asset to all concerned; contractors will be doing their part by promoting the gospel of good lighting and reap the additional work that will ensue.



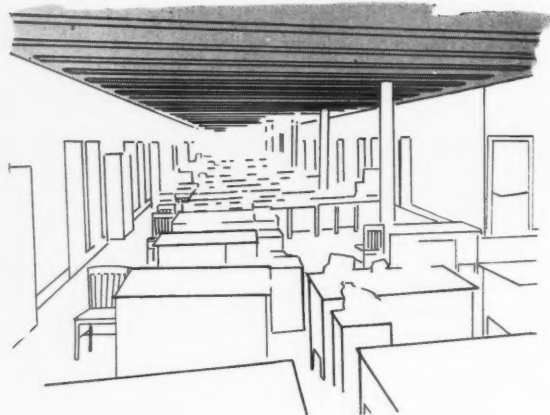
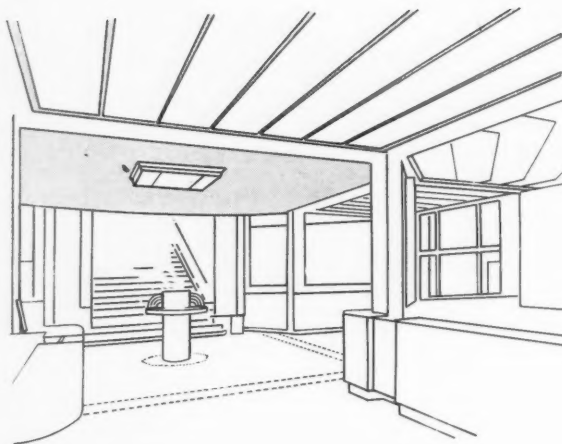
GOOD OFFICE LIGHTING is a must in today's war plants and offices. Long hours spent over reams of paper work produce eye fatigue that can be reduced only by adequate illumination.



SUPPLEMENTARY FLUORESCENT lighting provides high-intensity illumination for working on plane parts in this rehabilitated plant. Units are installed on frames close to the jigs.

Lighting Postwar

A practical appraisal of lighting methods and practices that appear on the postwar horizon.



POSTWAR lighting development, in methods and markets, may take up its course with dramatic new light sources, sleek fantasies of fixtures, and vastly increased lighting intensities beyond present imagination. But careful analysis of the postwar thinking and planning of men concerned with lamp and fixture development brings out a much more practical, down-to-earth approach to what is inevitably one of the greatest market potentials ever encountered by the electrical industry.

Improvements in lighting sources and their adaptability to lighting tasks are on the way. It is not likely, however, that such advances will be revolutionary. Fluorescent lighting is in itself a new source, only a little more than five years old. If we may use the development of the filament lamp as a reference, it is notable that the incandescent lamp improved in efficiency and quality through many years, each step opening up new vistas of lighting design and application. It is conservative forecasting, therefore, to predict that improvements in fluorescent lighting postwar will expand our resources of lamps and methods toward new lighting applications, but these improvements will come as methodical progress along substantially familiar lines.

In luminaires, the course of development is less easy to predict. Plastics and light metals will be used far more extensively than heretofore. Aluminum, available in enormous quantities after the war may make a strong bid to become the universal metal and its adaptability to fixture design is obvious. The extensive use of non-metal reflectors on wartime fluorescent industrial units has proved the practicability of such materials in lighting fixtures. There will be a strong effort on the part of the manufacturers of hard boards and plastics to include their products in postwar lighting fixture designs. Glass in optical forms, diffusers, lenses, louvers or as translucent enclosures will take its normal place in postwar commercial lighting with, in all probability, some keen competition from new plastics.

On the whole, however, in the immediate postwar period both lamps and luminaires will follow pretty closely upon the advanced designs that we had in the busy lighting years of 1940 and 1941. It is sound planning practice to set our sights, therefore, toward the lighting market with the lighting tools we already know in the reasonable confidence that we are in the practical forefront of lighting progress.

FLUORESCENT LAMPS

The hot-cathode fluorescent lamps will unquestionably dominate the postwar lighting picture. Although the great majority of sources in use today are still filament lamps, the fluorescent lamp will handle the burden of new lighting tasks in the future. What are the changes and improvements we can expect? Experts

say that continued improvements in maintaining the light output during the lamp life are certain. Early lamps dropped to 50 percent output in 500 hours, present lamps produce 85 percent of rated output at the end of 2000 hours. More improvement is in prospect.

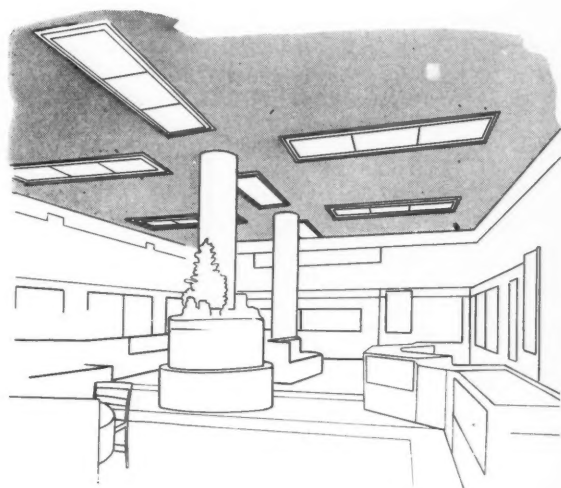
Higher lumens per watt efficiencies are a possible refinement, but substantially higher wattage are apparently not among the immediate prospects. The question is often asked, "What about the possibilities of a lamp requiring no ballast or auxiliaries?" This, we are told, belongs in the realm of radical and fundamental invention rather than the improvement of existing sources. Fluorescent lamps are electric discharge sources which require, as a fundamental circuit characteristic, some means of limiting the current flow. As for starting switches, several ballasts are now available which require no switch and provide instant starting. On the other hand modern "no-blink" type of starters are such an improvement over the earlier forms that it is a question whether the elimination of the starter is of pressing importance in postwar light design. The development of fluorescent lighting sources has, of course, carried on right through the war years. As a primary type of war industry lighting, it has had a huge growth in industrial application and the standards of illumination established during this era will have a profound effect on all lighting in the period ahead.

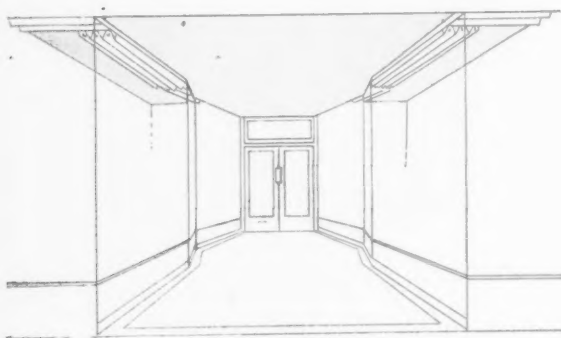
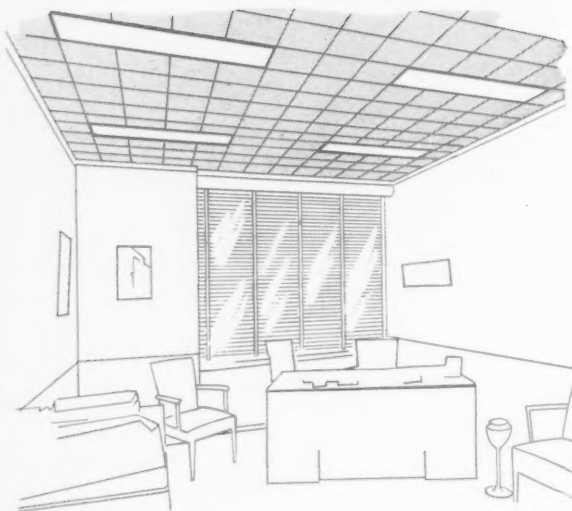
INCANDESCENT LAMPS

The emphasis on fluorescent lighting in considering modern illumination technique has tended to obscure the importance of incandescent sources in postwar lighting. It is important to remember that fluorescent lighting came into the industry at the time when radical improvements in filament lighting were underway. Tomorrow we may not attempt high level general lighting with filament sources, but they still offer economical sources for the lower levels required for warehouses, passage ways, occasional lighting and for high-intensity or specialized local lighting under modern general lighting systems. Filament lamps still provide the most simple, most adaptable and most widely useful sources available for postwar lighting applications.

COLD CATHODE

Cold cathode fluorescent lighting has been aggressively promoted in recent months as an industrial lighting system and is making a strong bid for postwar commercial, institutional and even residential acceptance. It has important advantages in decorative and spectacular lighting where the light source must follow architectural forms. "Code cathode" is one of the earliest successful forms of gaseous tube lighting. Installations vary from "Zeon" gas station lighting to a large industrial installation providing 35 foot-





candles of general illumination. Important present limitations are the high voltages used to energize the tubes and the low order of current flow (voltages in the 10,000 volt range and an upper limit of about one tenth of an ampere). The place of cold cathode lighting postwar is difficult to evaluate on the basis of existing installations. All the early hot cathode fluorescent jobs were exposed tubes without reflector or diffuser. When the novelty wore off, the lighting industry started to treat fluorescent tubes as any other light source and installed appropriate controls on the quality, direction and distribution of the light. Many of the new "cold cathode" jobs are still in the bare lamp stage, open patterns of tubes in sweeping lines or following architectural forms. One of the most striking of such installations is the lighting of the auto entrance platform of the new Hotel Statler in Washington. With the addition of quality control in appropriate luminaires or architectural forms such as coves and niches, "cold cathode" will unquestionably find an important place among postwar light sources available to the illumination engineer.

MERCURY VAPOR

The high intensity mercury vapor lamp had already gained wide acceptance for high levels of general illumination, particularly in the metal working industries, before the war. Alone or in combination with color correcting incandescent lighting they were helping to set new industrial lighting standards. Since then the 3000-watt lamp has been added to available sources proving especially useful in high bay installations.

A wider use of these versatile sources may be expected postwar in industrial applications and outdoor floodlighting. Most installations have been made with ballast equipment located at the fixture or as an integral part of the lighting unit. Several recent jobs which probably indicate a trend, however, have the ballasts located at a remote point reducing the fixture weight and simplifying maintenance.

INDUSTRIAL LIGHTING PROGRESS

Since the industrial lighting methods and applications have been enormously accelerated by the needs of wartime manufacturing, 24-hour schedules and new requirements in inspection precision, the pattern of postwar industrial lighting can be readily stepped up by a logical expansion of wartime jobs. An important inhibited factor, however, has been the progressive restrictions upon the use of metal with the lighting fixture manufacturing and in the associated wiring systems. Relaxation of metal restrictions will pave the way to improvements from the standpoint of design and structure.

The immediate postwar market will be made up largely of (a) new industrial construction for the manufacture of peacetime civilian requirements; (b) conversion of existing war manufacturing and subcon-

tracting plants to the production of peacetime commodities, and (c) improvements in existing plants devoted to the production of peacetime commodities to bring them into line competitively from the standpoint of manufacturing facilities with those plants which have enjoyed the benefit of wartime improvement and expansion.

On the basis of extending wartime lighting experience into the postwar era we may safely set our sights on intensities of 75 foot-candles and upward for industrial interiors involving any kind of critical work. While we think of war industry lighting as offering many examples of 50 foot-candles and upward, it is important to keep in mind that this is far above the average values.

More important, however, than an increase in the general average of illumination for industrial plants, is an increased concern for lighting quality. This will, in all probability, bring about the use of louvers, lenses and diffusing transparencies and other measures for the better control of quality even at some expense in foot-candles.

Multiple lamp reflector units and continuous row assemblies will probably continue to be the most popular items for general industrial lighting. A return of the highly efficient RF (rectified fluorescent) units can be expected as well as the incorporation of cold cathode light sources in industrial reflectors. For high bay work 3,000-watt mercury lamps have proved to be a useful and popular source. Relief from wartime restrictions will bring much wider application of this type of equipment.

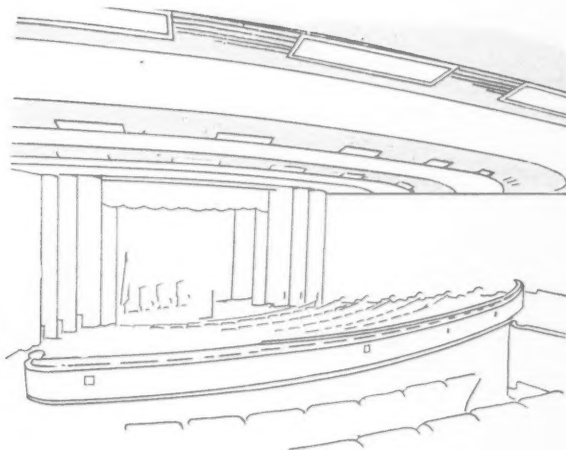
The solution of war production lighting problems has opened up a whole new field for local and specialized lighting applications. Against a background of relatively high general illumination supplementary lighting provides special intensity or quality for highly critical production operations or inspection. Fluorescent lamps in supplementary lighting units are inherently cool and can be placed very close to the operator at the work without discomfort. By the use of fluorescent and supplementary lighting illumination levels of 100 foot-candles and higher are readily obtainable.

COMMERCIAL LIGHTING

Spectacular progress in the immediate postwar era may be expected in the field of commercial lighting. Halted, practically to extinction, by WPB rules in the midst of the greatest era of progress in the history of lighting, the market potential has continued to build up with no prospects of satisfaction until commercial lighting fixtures can be made and sold again without restrictions.

But again, progress will follow lines of installation layouts and designs already evident in prewar jobs. Among the general categories of systems we may expect to lead in postwar commercial lighting are:

1. Flush troffer fluorescent, with louvers and diffusing covers.



2. Fluorescent cove lighting as a part of structural designs.

3. Close-to-the-ceiling surface fixtures with appropriate light controlling enclosures or louvers.

4. Inbuilt lensed incandescent units for spotlighting commercial displays.

5. Skylight panels, or "luminous ceilings" for large area, low brightness general lighting.

The above systems do not, of course, exhaust the many methods and designs that will be available. In general we may expect the bare lamp designs, prevalent in early fluorescent installations to drop off to a relatively small percentage of the new jobs.

Predictions of some authorities indicate the greater concern for illumination quality and the elimination of glare as of equal importance with increased intensities in store lighting.

RESIDENTIAL LIGHTING

Predictions about the place of lighting in the postwar home vary from forecasting complete recessed fluorescent lighting throughout to more conservative emphasis on fluorescent kitchen and bathroom lighting with the conventional IES lamps for other areas. Lighting men are agreed, however, that fluorescent lighting, probably inbuilt, will play an important role in the salability of postwar homes to a lighting conscious public.

Estimates of the average value of lighting fixtures in postwar homes show a complete turn-around from the long prewar decline. With new emphasis on built-in lighting, both fluorescent and incandescent, the budget figures for wiring and lighting in new homes must be considerably increased. Advanced designs of home lighting involving ceiling panels and coves, 50 foot-candle bathrooms and kitchens and other modern lighting equipment may run into several hundreds of dollars. On the whole, residential lighting promises to offer a much more substantial market, both in the indi-

vidual house and the over-all prospect, than the industry has seen in many years.

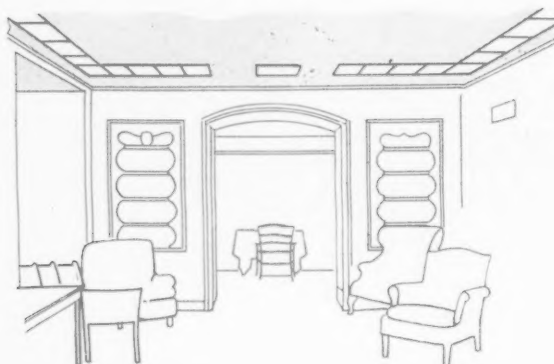
For existing homes a number of attractive designs in fluorescent fixtures now on the drafting boards will be available for installation on present outlets.

OUTDOOR LIGHTING

One of the most important markets for lighting postwar that has had little opportunity to develop in the last three years is the field of outdoor lighting; sports, spectacular, floodlighting, service stations, highway and intersection lighting. Most State postwar plans include, as important elements of highway planning, extensive road, crossroad, bridge and approach lighting. There is room for great development here as our best highway lighting standards fall far short of optimum intensities and quality.

The elimination of glare and even light distribution rank as the two major problems in street and highway lighting. To solve either will require much closer spacing of units than we have heretofore considered practical in this type of project. A one to one ratio of mounting height to spacing, with high mounting height and well designed reflectors will probably be used to solve both problems. Intensities will be considerably increased. And improved highway lighting will probably reflect back into many of our cities that are long overdue for a relighting job.

The postwar lighting market ranks as one of the great business opportunities of all time. Ready public acceptance, desires built up by dimouts, brown outs and blackouts, barriers of wartime restrictions and scarcity has created a unique market situation. Whether the market will be reached and satisfied with make-shifts and opportunistic exploitation, or provided with good insulation reflecting sound engineering and lighting progress may be determined by the extent of our postwar planning. It is not too soon to start.





No "SHADOWTAGE" here

"Shadowtage" means sabotage due to shadows on the working plane — especially when they blur delicate machining operations held to tolerances of 1/10,000th of an inch.

The best-known answer to "shadowtage" is the scientific installation of shadowless and glare-free fluorescent lighting.

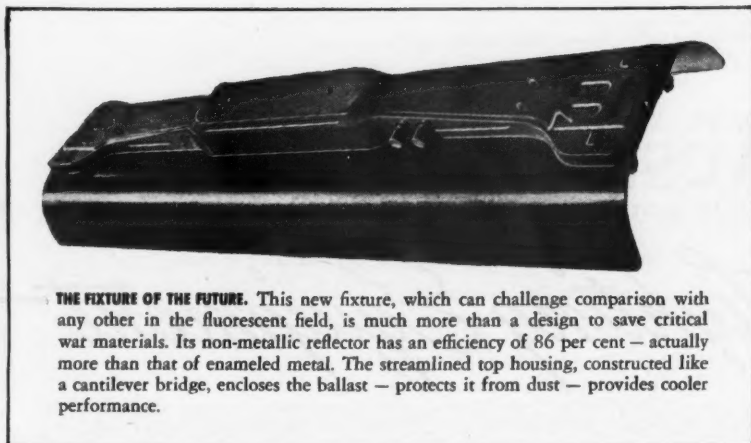
It is your job to see that industry is making full use of the advantages of satisfactory levels of illumination.

It is our job to supply to you the fluorescent and incandescent lighting equipment that is helping to speed war production all over the country.

And now — years ahead of time —

Sylvania is producing the fluorescent fixture of the future. A revelation in simplicity and adaptability, *one* standard fixture meets any industrial lighting requirement. Similar developments may bring economical fluorescent lighting into American homes after the war.

For industrial fluorescent lighting equipment, designed to work together, specify Sylvania Fluorescent Lamps, Fixtures and Accessories for replacements and authorized new installations.



THE FIXTURE OF THE FUTURE. This new fixture, which can challenge comparison with any other in the fluorescent field, is much more than a design to save critical war materials. Its non-metallic reflector has an efficiency of 86 per cent — actually more than that of enameled metal. The streamlined top housing, constructed like a cantilever bridge, encloses the ballast — protects it from dust — provides cooler performance.

SYLVANIA

ELECTRIC PRODUCTS INC.

Formerly Hygrade Sylvania Corporation

*Incandescent Lamps, Fluorescent Lamps,
Fixtures and Accessories, Radio Tubes,
Cathode Ray Tubes, Other Electronic Devices*

Today:

WE ARE BUILDING BETTER LIGHTING FOR WAR

Tomorrow:

BETTER LIGHTING FOR PEACE

In practically every phase of the Nation's War Effort, Westinghouse Lighting Equipment is helping speed the day of Victory. Protective lighting guards war plants and prison camps. Industrial and commercial fixtures expedite vital war production. Aviation units make night flying safer. Marine equipment serves on the seven seas.

To provide the best possible lighting for these varied requirements, intensive research and product development work has been necessary. The "difficult" we have done at once; the "impossible" a little later. The net result is that, despite restrictions on critical materials, we are today building the finest line of lighting equipment in our history.

Naturally, the "know-how" acquired in developing better lighting for war will help us to build *even better* lighting for peace. Then, as now, you may specify "Westinghouse" with confidence. Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, O.

Tune in John Charles Thomas, NBC, Sundays, 2:30 P. M., E. W. T.

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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



Lighting Equipment

RLM

New 2FNR-40 FLUORESCENT LUMINAIRE with nonmetallic reflector. Available for 2 or 3-lamp, 40-watt (and 2-lamp, 100-watt) individual or continuous strip installations.

New Aviation CONTACT LIGHT (right) sturdily built to withstand 100,000 pound deadweight loading. Widely used for marking runways in civil and military airports.

New 24-inch SEARCH-LIGHT (above) provides a high candlepower concentrated beam of light over great distances. Used for protective lighting in industry as well as for marine use on shipboard.

Type 5G-10 REFRACTOLUX LUMINAIRE (below) for protective lighting around war plant property lines. New smooth surfaced globe stays clean longer, simplifies maintenance problems.

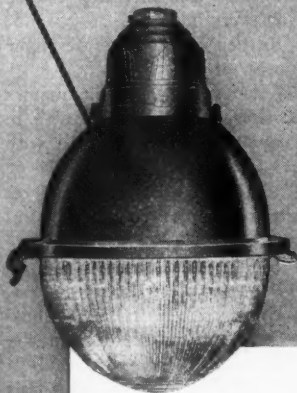
New SEADROME CONTACT LIGHT permits clippers and naval planes to land safely on the water at night. Light may be remotely controlled by radio where desired.

Westinghouse MAGNALUX, popular indirect commercial luminaire. Provides high-intensity, glareless illumination that speeds Wartime clerical and administrative work.

Westinghouse MILLITE (below) is built for lighting heavy service industries. Constructed of porcelain enameled steel with impact-resisting glass cover, unaffected by sudden temperature changes.

FILLING WARTIME NEEDS IS A FULL-TIME JOB

Supplying the lighting immediately needed for war is a full-time job here at Westinghouse. And we're staying *on top* of that job, hence are able to make prompt delivery on most items ordered. If YOU need Wartime Lighting Equipment, contact the nearest Westinghouse Office or Westinghouse Lighting Distributor.



EDITORIALS

W. T. Stuart, Editor

Ease Labor Needs By Subcontracting

As war production edges upward toward new levels under terrific pressure from Washington, manpower scarcity looms as the limiting factor to further acceleration. Limitations on less essential civilian manufacturing and commerce are now being pressed to drive workers into the labor-hungry war industries and fill the requirements of the armed forces.

The most urgent reason for the drastic curtailment of new construction is to tap our large reservoir of construction labor, we are told, for direct war production work. The need is obvious. It is unlikely that anyone can take issue with the urgency of such a shift in labor forces at this stage of the war.

The methods used, however, to place construction labor in war industry is open to argument. In electrical construction, for instance, new building prospects are thinning out. Mechanics are laid off. They head for the shipyards and industrial plants where jobs are waiting, eventually learning the ropes of new management and supervisory routines. But all this takes time. Highly organized and efficient teams are broken up. Important contractor management resources are discarded in the process.

The same men can be shifted to war production projects swiftly, at top efficiency, in trained teams and under familiar supervisory condition by the simple expedient of hiring the contractor as a business organization to take over the needed work under a subcontract procedure.

Wherever contractors have fought their way through the inertia of established custom and sold a shipyard, for instance, on subcontracting a production operation, it has proved highly successful for both the yard and the contractor.

There are still, however, prime contract conditions and traditions that discourage subcontracting. It seems to us that it would be far easier to alter contracts in a way that would encourage subcontracting than to destroy go-

ing concerns in order to gain access to their labor and supervisory forces.

After all, John Jones, Electrical Contractor, has been in business a good many years. He will continue to be in business long after the war. His stability is an important economic asset in war and peace. The labor hungry industries are admittedly in dire need only for the duration. There is no justification for building up large permanent electrical staffs far beyond their normal peacetime requirements.

Renegotiation Stifles Initiative

Members of a Ways and Means subcommittee have been studying renegotiation to bring out the facts. Among the witnesses who addressed the committee was NECA Manager L. W. Davis, whom independent reporters give credit for one of the strongest and most able discussions presented in opposition to the unilateral revision of binding contracts by price adjustment boards under the Contract Renegotiation Law.

Emphasizing that electrical contractors differ in "know-how" and that renegotiation tends to reward the inefficient and less skilled, he warned that the eventual result is high costs for government construction. He brought out, too, that the arguments for renegotiation on the basis of adjusting contracts where costs had to be learned by experience have no application to electrical construction.

He concluded with a plea (1) that construction be exempted from renegotiation (2) that contracts entered into prior to April 28, 1942 be exempted and (3) that the Act be amended to incorporate losses as well as profits in any renegotiation.

In the early stages of war production there may have been some justice in the claims of renegotiation proponents that large contracts and unknown costs required some device for later adjustment. Such claims have no valid application to electrical work and it is

doubtful whether any significant number of current contracts, even in manufacturing, are made without known costs. It is high time the contract was restored to its proper legal status, as a binding instrument on both parties.

The effects on business initiative of renegotiation is aptly summed up in a phrase overheard at the hearing—"First prize to the loser".

It's Up To Us

A strong plea to stay on the job has been produced by NISA in shop poster form and is now displayed in many motor shops.

Under the caption "It's up to us to make sure that electric motors, the driving power of American wartime industry, are kept turning!" the poster lists why men should give the best in skill, know-how and facilities and be on the job every hour.

"(1) Burned out motors slow our nation's war effort.

"(2) Rewound and rebuilt motors make possible a tremendous saving in critical materials over replacing with new.

"(3) It's our job to rebuild and rewind electric motors and electrical equipment.

"(4) As the men behind the men behind the gun, let's keep the nation's driving power rolling—industrial plants, mines, transportation, elevators, communications and so on."

Posters like this are excellent morale builders. In an industry whose work is rarely directly connected with military activity it is good to give the men the extra lift of a clear picture of just how they are helping.

Rating Bus By Temperature

This business of rating busbar capacity on the basis of temperature rise seems to be one of those handy ideas that winds up sounding pretty silly.

First it was a 30 degree rise, then a 70 degree rise, now some talk of using a much higher temperature as the base for determining safe current capacity of busways.

Actually, it seems to us, large temperature rises in a bus system or any other wiring system are so uneconomical and so wasteful that the whole subject is reduced to academic interest. Where the safety limit can be drawn is an interesting subject for tomorrow's luncheon table. It is conceivable that some installations could be operated at a bright cherry red without undue danger to the surrounding structure.

However, urgent as copper economies are, there is no evidence that power resources are so ample that we can afford to dissipate any considerable quantities of energy from wiring systems. Nor is there any net economy in critical materials if voltage losses are so great that lighting levels and motor horsepower are reduced at the utilization points. And inexorably, where there's copper temperature rise, there's voltage loss.

With all due consideration for the urgency of strict material economy, especially in copper, there is a practical limit where the distribution system becomes part of the load and consequently a burden on copper all the way back to the generator.

Wanton Waste

A recent fire report by the IAEI for the year 1942 lists electrical fires in the northwestern and western section of the country including such cities as Seattle, Wash., Portland, Oregon; Los Angeles, Cal.; Boulder, Colo.; and Chicago, Ill. Some 1,319 fires of electrical origin are reported with a total loss of \$240,753.

That in itself is not spectacular. The real eye-opener and most discouraging part is the analysis outlining the causes of these fires. About 15 percent (199) were due to improper installation, including tampering by incompetents; 20 percent (267) were caused by failure to replace or repair damaged or worn out equipment; 33½ percent (440) were due to motor winding failures; 15.5 percent (204) were caused by electrically heated appliances or devices left in circuit unattended, in contact with or too close to

combustible material (no code violations).

Negligence and carelessness were responsible for almost 84.4 percent of the electrical fires reported. Although classification as to industrial, commercial or residential fires was not given, the figures decry wanton waste.

A small portion (due to improper installation) might have been prevented by inspectors in their routine duties—if inspection was required. More might have been prevented by systematic reinspection—though lack of funds and manpower has frequently handicapped such efforts. The real responsibility, however, rested on the owners and management—a responsibility of preventive maintenance after an installation is in operation.

The initial responsibility is really the responsibility of electrical men—inspectors, contractors, engineers and maintenance men. We know electricity, how to harness and use it; we are aware of its hazards. We should apprise the users of such systems and equipment accordingly.

A more aggressive educational effort along these lines is badly needed if we are to keep production at a maximum and inexcusable waste and destruction at a minimum.

Cutting Overhead Manhours

A good many of the motor shop operators, in spite of record business, are wisely streamlining shop practices and office methods. They figure that it is a good time now to make changes and try out new schemes looking toward trimming overhead man-hours and costs.

The National Certification Board of NISA under Frank Willey and Selden High, has just issued a bulletin describing a method of billing and accounting of receipts that promises an important saving in time over some older methods. Essentially the plan uses carbon copies of invoices as sales journal and accounts receivable ledger. A special cash journal deposit slip further expedites handling checks.

It is good practice to overhaul accounting systems periodically anyway. Routine bookkeeping and paper work is supposed to be the ready servant of management. Once traditional practices get into a rut, however, it's often easier to change the management than the system.

Washington Notes

West coast manpower is now allocated on a "modified Buffalo plan" with ship and plane manufacture getting top priority. No new contracts, says WPB Chairman Donald Nelson, will be placed in the area. Stringent manpower rules threaten the existence of small plants and businesses.

► Quarterly identification need not be shown in placing orders for B products under a new interpretation. For example "Preference Rating AA-1, Allotment Number W-1" would be enough. It must, however, be shown on orders for controlled materials except MRO and SO.

► FHA is surveying housing markets to determine potential purchases postwar, suitable sites and capacity of local building industry to handle work in immediate postwar construction. The study will include an analysis of the availability of building materials and supplies when restrictions are lifted—"undertaking this survey to be better prepared to assist the building industry in reviving normal activities immediately after the necessary restrictions on construction are lifted" says FHA Commissioner A. H. Ferguson.

► July construction rate was six percent below June and a further decline of 33 percent is scheduled before the end of the year according to WPB reports. July volume was \$659,511,000 and August figures are estimated at \$603,450,000.

► Expansion of government financed industrial facilities in July declined to \$371,542,000, 41 percent below the corresponding month last year.

► Men with critical occupation qualifications will now be referred to U.S.E.S. by draft boards before being ordered to report for induction and U.S.E.S. may recommend deferment until a new employer files a "42-A".

► Interior Secretary Harold L. Ickes now has jurisdiction over three southwestern dams and their power plants, taken over from Federal Works Agency. Already the biggest controller of federal power projects through the Reclamation Bureau and the Bonneville Power Administration, Ickes may yet take over REA from the Department of Agriculture.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

DOUBLE TIER DUCT FEEDS WELDING UNITS

WIRING

Multiple electric welding units, mounted back to back on a mezzanine, in a Michigan defense plant, are fed by two short lengths of Flex-A-Power. To mount the duct in tier fashion, the Koontz-Wagner Electric Company, South Bend, Indiana, electrical contractors, fabricated two angle iron "A" supports—one for each end of the duct run. Angle floor braces fastened to intermediate crosspieces add rigidity to the supports.

Standard duct hangers, furnished with the busway, suspend the top length of duct from the top crosspiece of the "A" frame. The same type of hangers are used to mount the second duct length to intermediate crosspieces immediately under the top duct.

Connections from the fused "plugs" on the duct to the machines are made with conductors encased in flexible metallic tubing. The duct runs and sup-

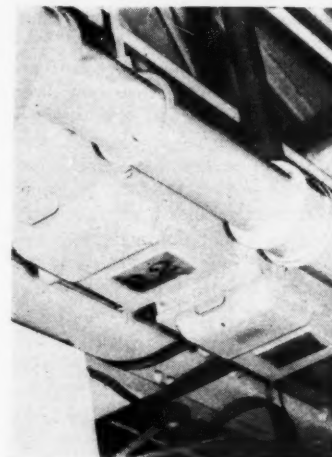
ports are so arranged that, should the welder units be moved, this distribution scheme could be quickly dismantled and relocated.

CODED CIRCUIT SWITCHES

INDUSTRIAL

Coding of one type or another is a recognized time saver for electrical maintenance crews. Color coding is a standard method of identifying circuit conductors, particularly the grounded or neutral wire. This type of identification is extensively employed in both simple and complicated electrical control circuits.

Circuit conductor identification is not enough. There should be some method of identifying motor and branch circuit controls and switches mounted remote from the machine. There are numerous ways of accomplishing this. Some plants stencil the name or operation of



NUMERICAL CODE identifies switch with the motor or machine it serves. Large numbers are printed on cards and placed in index frames on exterior of switch cover. Numbers are clearly visible from aisle below duct lines.

the machine on the switch cover. Some use no means of identification at all—necessitating the tracing of the circuit each time a machine is shut down.

A numerical code is used at the Tool Steel Gear and Pinion Company plant in Cincinnati. As is usual in many plants, each machine in this organization is tagged with a specific number—a practice which simplified quick identification, relocation of the unit and keeping records of its performance, spare parts and maintenance costs. The same code is extended to the motor disconnect switches which, in this case, are mounted to bus duct on the ceiling of the working area. For example: machine No. 22 has its circuit disconnect switch some 25 or 30 feet away on the ceiling mounted bus duct, identified with the same number "22". Thus, if an electrician wants to work on this machine he follows the duct line in the aisle and pulls switch No. 22. There is no need for the lost-time chore of tracing out conduit lines to locate the proper switch.

Large index frames, mounted on the



COMPACT DISTRIBUTION scheme, utilizing a double tier of short bus duct lengths, feeds this double row of welding units in a midwest defense plant.

ONE UNIT • ONE ORDER • ONE SHIPMENT • ONE INSTALLATION

NEW LIGHT-DUTY CSP POWER TRANSFORMER REPLACES 43 SEPARATE PIECES OF EQUIPMENT

This complete factory-packaged substation is first choice for industrial service.

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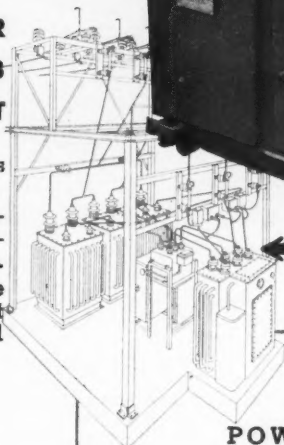
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the new CSP Power Transformer.

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WIRES?**



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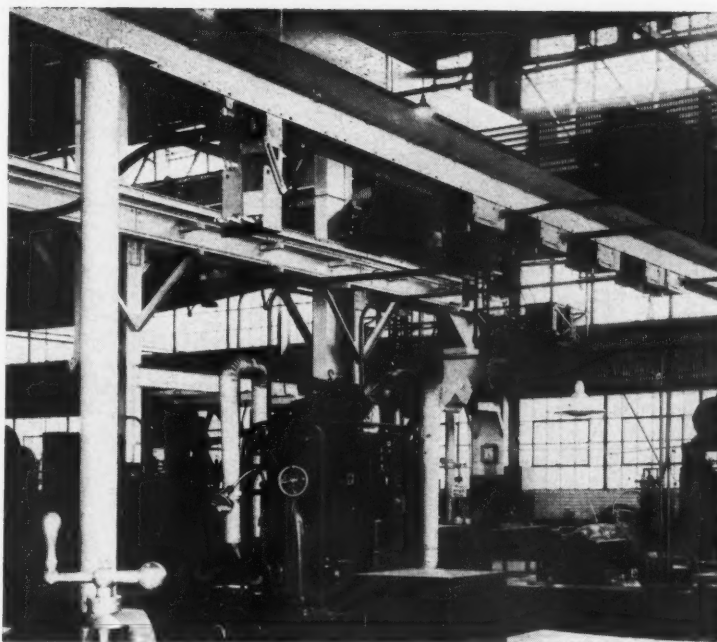
BURNDY electrical connectors

outside of the switch cover, give added flexibility to the coding system in this plant. Cards with large numerals painted or stamped thereon are inserted in these frames. If a particular switch is removed or replaced, it can be used elsewhere in the plant by simply placing a new card in the frame. If numbers are painted on the switch, difficulty is often experienced when a change occurs—either the identification must be removed and repainted or the entire unit must be refinished. The simple method described above eliminates all this extra work.

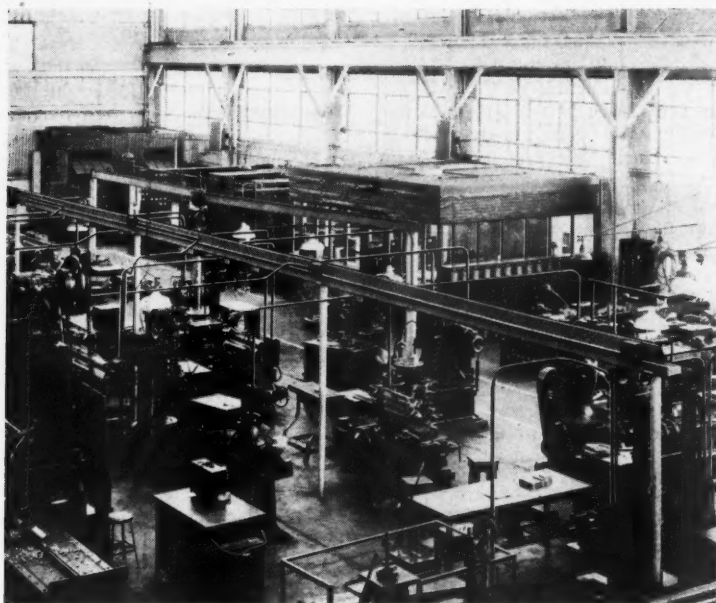
BOILER TUBES SUPPORT BUS DUCT SYSTEM

WIRING

When an Ohio defense plant decided to install a Flex-A-Power distribution system to feed a group of machine tools, they encountered a problem of supporting the duct. Ceiling suspension was impossible because of an overhead traveling crane operating in the department.



CLOSE UP VIEW of boiler tube support showing the welded flange and angle iron saddle in which duct rests.



DISCARDED BOILER TUBES support this bus run feeding machine tools under a crane in an Ohio defense plant. Inverted "V" trough on top of run affords added protection to duct.

Floor supports was the logical solution. In order to conserve materials, a number of old discarded boiler tubes reposing in a scrap heap were pressed into service. These tubular columns were grouted into the concrete floor on 20-ft. centers and fitted with flat steel plates welded to the top. Two short pieces of angle iron welded to each plate formed a shallow "U" shaped

saddle in which the duct rested.

Motor circuit distribution plugs were mounted on the under side of the duct with conduit extensions to the machines. An inverted "V" shaped sheet steel trough was mounted to the top side of the duct run, offering added rigidity across the spans and protecting the duct from damage by hoist chains and hooks.

TRANSFORMER MAINTENANCE

INDUSTRIAL

When transformers near the end of their useful life, good maintenance becomes increasingly important. C. E. Ross, electrical engineer for Hood Rubber Company, Watertown, Mass., has been doing an excellent job in this respect. One of their substations is powered with three banks of power transformers that have been grinding out the juice since the last war. One bank of three 625 kva. self-cooled single phase transformers is used as the base bank. The other two units are each 3000 kva. 3 phase water-cooled units which were built during the last war. These 3000 kva. units alternate with the base bank. By the time the afternoon peak approaches, the alternate base load water cooled unit's hot spot temperature hits 70° C. and is dropped off the line as the other water cooled unit is brought on. By keeping down the hot spot temperature of the alternating transformer banks, sludging, which was formerly quite a problem, has now been almost entirely eliminated.

Previously, when the water cooled units operated alone, hot spot temperatures were of necessity allowed to approach 90° C. and 95° C. and the water-cooled banks would sludge to beat the band. Sludging of course can't be tolerated in a water-cooled unit. Coils become thickly coated, less heat is carried

away, the hot spot temperature increases, sludging increases and coils become more thickly coated until finally this vicious cycle ends in disaster if not properly taken care of.

The first time temperatures began creeping up, both units were dismantled, transformer coils washed down, cooling coils scrapped clean (and this amounted to quite a job) and the units were re-assembled with clean oil. Within a comparatively short time, temperatures were observed to be increasing again. This time, after dismantling, cooling coils were cleaned with an Oakite solution (which left the copper coils gleaming) and re-assembled again.

It was at this time that it was decided to move in the bank of three 625 kva. transformers to be used for base load so that operating temperatures could be controlled. After a few experiments it was found that if the hot spot was kept at or below 70° C. practically no sludging would occur. Thus the operating schedule was adopted which is still used today. This was some years ago and to date, untanking and cleaning has not been necessary.

The oil is tested every six months and filtered when necessary.

GROUPED CIRCUITS SAVE MATERIAL

WIRING

Before Ray Stroppel, maintenance engineer for the Tool Steel Gear and Pinion Company, Cincinnati, Ohio, decided to consolidate certain electrical circuits, there was an 80-ft. stretch of wall in the plant that was adorned with 28 conduit runs of various sizes. Now there are just two raceways which enclose all circuits mentioned above.

His solution to the former heterogeneous mass of conduits was the installation of two 80-ft runs of steel square

duct. Each run was equipped with a welded steel barrier to divide the duct into two separate compartments. One line of duct now houses the office and plant intercommunication circuits and the telephone system. The second duct accommodates 230-volt power and 115-volt lighting circuits.

The new duct lines provide numerous knockouts for both top and bottom branch circuit conduits. Not only do the raceways accommodate all existing circuits but provide ample space to take care of any future expansion of the four systems mentioned.

The conduit and fittings which were replaced have been salvaged for use on other circuit extensions where duct is not practicable.

EXTENSION CORD MAINTENANCE

INDUSTRIAL

The easiest way to maintain extension cords is to cut them off and throw them away. This is precisely what was done at Hood Rubber Company, Watertown, Mass., manufacturers of rubber footwear and wearing apparel, who are at present making rubber boats and self-sealing tanks for the war.

In the manufacture of these rubber components, each part is laid on a long assembly table some thirty feet in length. During the process, a certain amount of trimming is necessary. Each layer of rubber is trimmed the full length and is done with an electrically heated trimming knife much on the order of a soldering iron only smaller and lighter with a sharp cutting edge.

Formerly, these hot knives were trailed by long extension cords which were continually tangling and kinking until sooner or later they ended up in the repair shop for splicing. The maintenance problem became so acute that



EXTENSION CORDS have been eliminated. The hot cutting knife retains its heat long enough to allow one cut, after which it is plugged back in for reheating. Much time and material in maintenance of the many 50 foot cords has thus been saved.

something had to be done about it, so it was decided to cut them off and throw them away. Just a few inches were left to accommodate a male plug, and to reach the receptacle mounted on the drop arm that holds the knives when not in use. Only a few seconds are required to make the cut and the knife retains enough heat to make one trim. When the trim is completed the knife is hung up and plugged back in to heat up for the next cut.

This is one instance which proves that one way to eliminate maintenance on equipment is to eliminate the equipment.

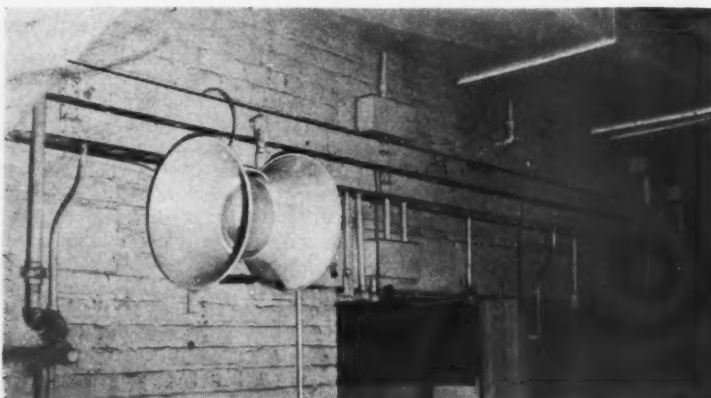
MACHINE FEED PANELS

WIRING

Flexibility and availability of feeders is invaluable on a machine tool floor. There are, of course, many other instances where feeder flexibility is convenient, but where production procedures change often, as in machine tool work, much time, effort and material can be saved by proper planning of feeder layout.

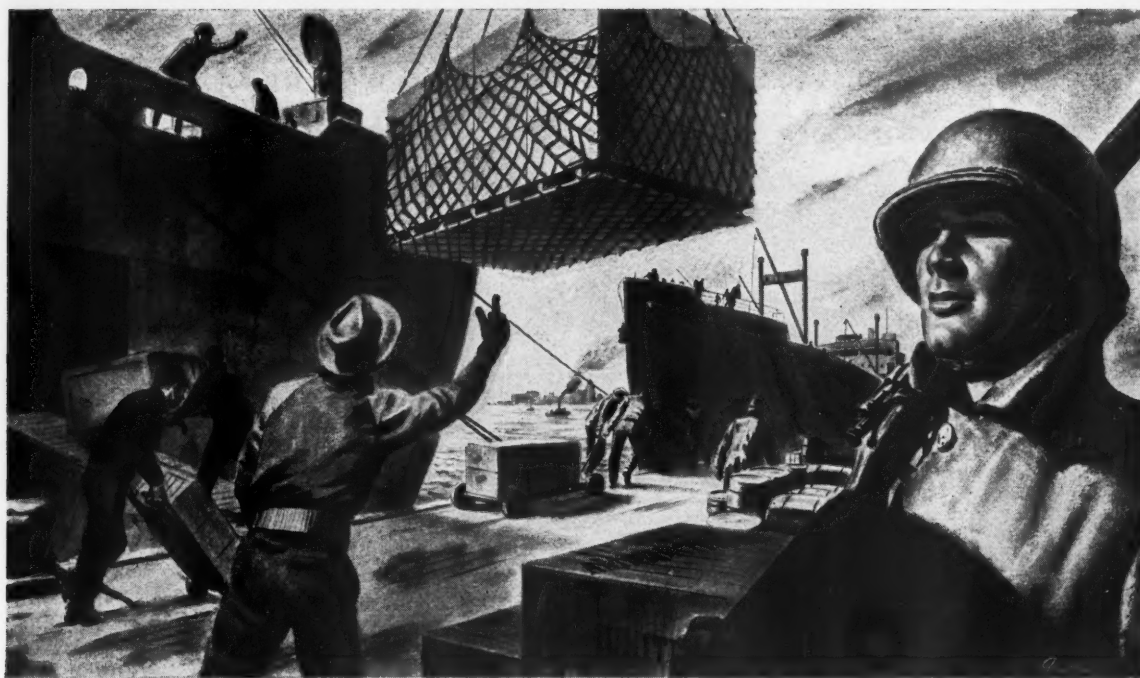
Heald Machine Company of Worcester, Mass., formerly had an overhead feed with drop-circuits to individual machines. Besides their unsatisfactory appearance, these drops interfered with overhead crane operation. Consequently, Carl L. Knutson, plant engineer for Heald, designed in conjunction with manufacturer's engineers, a panel which would accommodate a thermal breaker and eight 550 volt three phase circuits. The dimensions of the panels

[Continued on page 150]



PARTITIONED DUCTS accommodate numerous circuits of four different electrical systems, replacing an existing mass of 28 conduits.

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION



Ammunition caught 11-week-earlier convoy

Special Lights Saved 81 Day Delay Getting Powder Plant Into Production

The big new powder plant was almost ready to start making explosives when a vital detail brought operations to an abrupt halt. Production could not begin without floodlights with special ring bases, essential to inspection inside the huge boiling tubs. The best quoted delivery for the floodlights was 12 to 14 weeks—a paralyzing quarter-year delay in getting ammunition to the fighting lines.

Wesco was consulted and quickly contacted a small manufacturer. The "floods" were produced and delivered within 10 days, averting nearly 13 weeks' stoppage and putting production back on schedule. The finished ammunition was actually on the docks 11 weeks earlier.

Wesco's many contacts and sources of supply permit emergency assembling and delivery of materials; and this time-saving on the home front means life-saving on the battle front. The Wesco services which speed war production today will prove invaluable to your peacetime business—after Victory.

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INDUSTRIAL ELECTRIFICATION

ENGINEERING • INSTALLATION • MAINTENANCE

Matched Motoring Reduces Operating Costs—II

An outline of the procedure for correcting power factor
by a reapplication of motor to load.

LAST month an attempt was made to justify from an economics standpoint, a large scale program for improving plant power factor. Now, an outline will be presented as to the exact procedure for obtaining the desired power factor improvement.

Increased power factors can be obtained by one or more of three general methods. Capacitors (static condensers) can be used at the end of various feeders or in connection with inductive loads to maintain rated voltage through power factor correction. Leading power factor synchronous motors or synchronous condensers floating on the line will also give the same desired results as the capacitors. Or the third method is to remove or reduce the cause itself. Poor power factor can invariably be traced to underloaded squirrel cage induction motors. Power factors range from 62 percent to 92 percent for fully loaded motors depending upon size and speed. No load power factors range from 15 percent to 40 percent.

It is generally good practice to apply synchronous motors wherever possible, however the various aspects such as starting torques, increased space requirements and added cost must all be taken into consideration. In many cases it has been found economical to install unproductive equipment such as synchronous condensers and capacitors. But the inductive kva. can best be reduced by operating the inductive equipment within its full-load range where its power factor is maximum, and then raise it as much further as desired by the use of corrective equipment.

As a concrete example of what can be done by reapplying motors that closely match the load, one engineer increased his power factor fifteen percent merely by reducing the inductive kva. inherent in underloaded machines. He did this without spending one cent for new equipment. With the aid of meters and several picked men, a complete survey of load characteristics was made of every motor in the shop. Data was then compiled and studied, and a general juggling of motors followed without interruption to production. Adapter plates for changed mounting dimensions, the necessary pulleys, sleeves, couplings, etc., were all made ready in advance and changeovers took place during short shutdown periods.

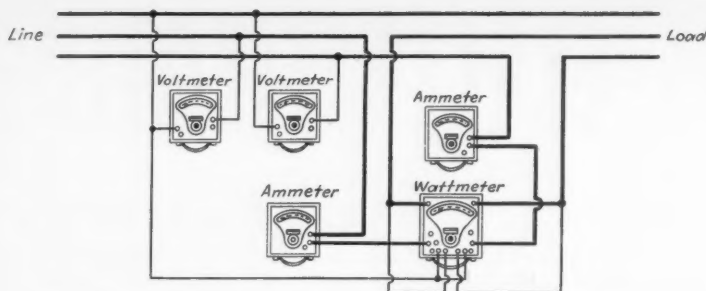
So, it can be done if only the ambi-

tion and initiative are present to carry the program forward.

Machine tools are perhaps one of the more prolific violators of improved power factor. This is no reflection on the machine tool designer, for he designs his machine to carry a certain maximum continuous load and specifies a motor to carry it. However, by the time the machine tool finds its niche in the production line, it may be working day in and day out for years on end at 50 percent or less of nameplate rating. Neither the tool designer nor the production engineer can foresee these conditions. Production demands alone, dictate to what use the various plant machine tools are put. However, it does behoove the maintenance engineer or electrician to see that his equipment



CURRENT TRANSFORMER as used here does not interrupt service for making test connections. Recording ammeter will give a complete picture of the entire load cycle, maximum, minimum and normal requirements along with the duration of each.



METER CONNECTIONS for wattmeter-voltmeter-ammeter measurements.

operates at a top, overall efficiency. This includes not only motors, but feeders, sub-feeders, panels, switchboards and transformers. Such a result cannot be obtained when a large percentage of the motors are operating considerably under-loaded.

Procedure

The maintenance man cannot proceed in this venture unassisted. He needs the cooperation of management first of all, but in addition, he needs the whole-hearted cooperation of the production engineer, the superintendent, the foreman and the man on the job. Especially the last mentioned, for the man at the machine has probably operated it since its installation, and undoubtedly knows it better than he knows his own car. He knows by the sound of his machine when it is operating as its heaviest load.

To begin with, management must be approached for consent to proceed with this re-application program. The complete procedure should be fully explained from beginning to end including time, effort and material involved plus results to be achieved. Be sure to point out that operating cost reduction is the objective. Next, the production engineer must be consulted to insure against variation of production that might mean heavier loading. The superintendent, his foreman and the machinist or operator can then be asked for their cooperation in carrying the program forward.

Meters

Meters, of course, should be in good condition, and the accuracy of their calibration checked against standards which every plant should carry as essential equipment. The metering can be as simple or as elaborate as one may desire, but the results will be the same. Recording meters are preferable in that they can be installed and removed after a period of several hours or several days and in the interim need not be attended. A recording ammeter and an indicating voltmeter will do the job very nicely. For more complete information an indicating wattmeter can be used in addition. Very often only a

recording wattmeter is available and with its use and that of an indicating ammeter and voltmeter, input current and power factor can be determined. If no recording meters are obtainable, indicating instruments will give the same result but require some one to be in constant attendance to catch the maximum loading point and duration. Clamp-on type ammeters can be used also, but in any case when indicating meters are set, assurance must be obtained from the foreman or operator, that maximum load is being applied at the time readings are taken. An accurate record must be made of all data. It is particularly important that duration of peak loads be known, for most generally they are the deciding factors in motor selection. Duration of normal loading and the number of recurrence of peaks in a given length of time must also be known.

It can be easily seen that all the desired information can be obtained from a recording chart, so long as the operator has given assurance that a normal operating cycle has been completed.

The following data should be recorded.

1. Machine identification number.
2. Motor identification number.
3. Application.
4. Complete motor nameplate data.
5. Maximum current. Duration.
6. Normal current. Duration.
7. Complete duty cycle.
8. Maximum kw. (if taken). Duration.
9. Normal kw. (if taken). Duration.
10. Voltage.
11. How motor is anchored to floor or machine.
12. Drive—gear, chain, belt or direct.
13. Drive pulley and shaft dimensions.
14. Mounting dimensions.
15. Driven pulley and shaft dimensions.

Mechanical data will be necessary if it is found that the motor is to be replaced. Current and kw. durations will, of course, be the same. Horsepower outputs can be found by use of a current

input—horsepower output curve which was published in the April issue of *Electrical Contracting* or they can be computed by use of approximate efficiencies taken from typical curves of motors rated same horsepower and speed. If wattmeter, voltmeter and ammeter are used, the power factor and kva. input can be obtained as follows:

$$(1) \text{ kva.} = \frac{\sqrt{3} EI}{1000} \text{ where } E \text{ is the line to line voltage and } I \text{ is the line current.}$$

$$(2) \text{ Power Factor} = \frac{\text{kw.}}{\text{kva.}} \text{ where kva. is determined by formula No. 1 and kw. is the reading of the wattmeter.}$$

$$(3) \text{ H.P.} = \frac{\sqrt{3} \times E \times I \times \text{Eff.} \times \text{P.F.}}{746}, \text{ where } E \text{ and } I \text{ are as defined above, and efficiency and power factor are in decimal form.}$$

Take a specific example of a set of readings taken as test data on a pipe threading machine driven by a 7½ h.p., 1200 r.p.m., squirrel cage motor.

E reads 223 volts

I reads 16 amps on peak; duration 12½ minutes, unloaded at 8 amps for 2½ minutes completing one full duty cycle

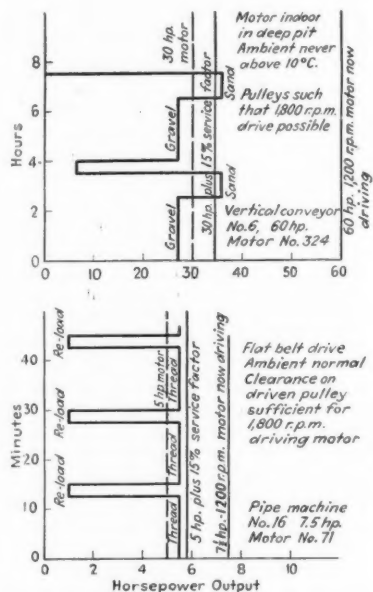
KW reads 4.8 kw. on peak; 1.3 kw. unloaded.

Peak values:

$$(1) \text{ Kva.} = \frac{\sqrt{3} \times E \times I}{1000} = \frac{1.73 \times 223 \times 16}{1000} = 6.17 \text{ kw. input.}$$

$$(2) \text{ P.F.} = \frac{\text{kw.}}{\text{kva.}} = \frac{4.8}{6.17} = .778 \text{ or } 77.8\% \text{ at this load point.}$$

The motor is operating somewhere between 75 percent and 80 percent of



LOAD CYCLE charts drawn from information obtained by test.

full load, and so, from typical efficiency curves for 7½ hp. 1200 r.p.m. motors, 85 percent is found to be an approximate efficiency value.

Consequently the horsepower output is:

$$(3) \text{ HP.} = \frac{\sqrt{3} \times E \times I \times \text{Eff.} \times \text{P.F.}}{746} = \frac{1.73 \times 223 \times 16 \times .85 \times .778}{746} = 5.5 \text{ HP. output}$$

approximately.

A five hp. motor with a 15 percent service factor gives that motor a continuous maximum rating of 5.75 horsepower which could nicely handle this load without excessive heating. In addition, the pulley clearances are such that an 1800 r.p.m. motor could be easily installed with a gain of about 5 percent in F.L. power factor for this individual load.

Temperature Considerations

To insure long insulation life, standards have been based on general concepts drawn from years of test and experience. Insulation does not break down immediately at arrival of some critical temperature, but by gradual mechanical deterioration with time. Both time and temperature are factors in insulation failure. A general rule of thumb is that for each 10° C rise above the rated design values, insulation life is halved.

Motors are rated on the basis of a 40° C ambient, plus a 40° C rise for open general purpose motors; a 40° C ambient plus 50° C rise for splash proof motors; and 40° C ambient plus 55° C rise for totally enclosed motors. The temperature rise is of course a function of motor loading, and will be the same regardless of its location. It is the ambient that must be given careful consideration, for a motor operating in an extreme temperature must be given certain allowances. If the ambient is substantially above 40° C, then some means of ventilation should be provided or a larger-than-required motor specified to reduce temperature rise, the former being the more satisfactory in usual cases. Conversely, if the motor is operating in a location where the ambient is substantially below the standard 40° C, then reasonable overloads may be applied to the motor without injurious effects to the insulation. It is to be borne in mind however that the IR loss at sustained high overloads increase more rapidly than the square of the power output, that is, a motor rated 50° C rise at continuous rated load may have a 100° C rise or greater at 150 percent continuous applied load. In the application of motor load, keep the ambient temperature in mind—40° C (104° F) is used in rating machines.

It would be expedient to take a quick check with a clamp-on ammeter of every motor in the plant to determine which are the worst offenders, and which are already fully loaded. However, it is recommended whether the motor is fully loaded or not that in due time, the above data be obtained and records kept so that in the event of an emergency the electrical and mechanical requirements for a replacement are immediately available. An added advantage can be derived from the records in that when ordering new equipment for identical operation, motor specifications can be accurately made without the usual lengthy calculation, estimation and unnecessary application of safety factors. Adequate attention must be given to speed and torque requirements. Be sure that the speeds of the interchanged motors match and that starting torques are sufficient. By all means, if it is possible to change pulley ratios, use a higher speed motor and take advantage of

higher efficiencies and power factors.

Keep in mind that full load power factors can be materially increased, simply by using a higher speed motor. As an example of the importance of the smaller motor's contribution to the overall increase in plant power factor, take the case of a 5 hp. and a 30 hp. motor. By using a 1200 r.p.m. motor instead of a 900 r.p.m. in both cases, the 5 hp. motor's full load power factor increases 7 percent, from 76 percent to 83 percent. The 30 hp. motor's F.L. power factor increases 3 percent, from 86 percent to 89 percent. By using the higher speed 5 hp. motor, 0.42 kva. of transformer and feeder capacity is released, while use of the higher speed 30 hp. motor releases 0.90 kva. of capacity. Thus, although the larger motor is six times as large as the smaller one, only a little more than twice as much kva. capacity is released. Both are important, but don't overlook contributions made by your smaller motors.

SURVEY FIELD SHEET			
1200 R.P.M. Classification	4/7/43 Date		
7½ HP. Classification	16 Machine Ident. No.		
Squirrel Cage Type	71 Motor Ident. No.		
Pipe Threading Application			
COMPLETE NAMEPLATE DATA			
6-448E Style	3 Phase	20.6 Current	
928764 Serial	60 Cycles	220 Voltage	
CS Type	1160 Speed	7½ HP.	
	West Mfr.		
TEST DATA			
Maximum: 16 Current	4.8 kw.	12½ Duration (min.)	5.5 HP. output
Normal: 16	4.8	12½	5.5
Minimum: 8	1.3	2½	1.0
223 Voltage	1168 Speed R.P.M.		
Complete Duty Cycle: 12½ minutes + breaking time 2½ minutes			
Cleaning and reloading time. Operator states this as the heaviest pipe ever threaded in this particular machine			
MECHANICAL DETAIL			
Dimensions:			
Driving Shaft: 1½" Diam.	4½" Length	3/8" Keyway	
Driven Shaft: 2½" "	7" "	3/8" "	
Driving Pulley: 6" "	5½" Width	3/8" "	
Driven Pulley: 10" "	8" "	3/8" "	
Mounting: 10½" par. to shaft	12½" perp. to shaft	5/8" size bolt	
Driver: Flat belt			
Anchored: Slide rail on cement floor (3/8" Expansion bolts)			
Further Detail: Maximum overall clearance dimensions for a driven pulley 42-30 in diameter and 14 in width			
Pulley center distance - 32"			

A SURVEY FIELD SHEET such as this should be given to the man doing the field work. From this data output horsepowers can be computed and load cycle charts drawn to determine actual motor requirements.

ELECTRONIC CONTROL MAINTENANCE TROUBLE SHOOTING CHART

GENERAL ITEMS FOR ALL TYPES OF ELECTRONIC CONTROL

General Information

One of the advantages of electronic control is the small number of moving and wearing parts. Because of the nature of the components—such as resistors, reactors, transformers, and capacitors, this type of control requires very little maintenance. The electron tubes themselves, while replaceable items, require inspection and testing at comparatively long intervals.

Many parts of electronic control are similar to those used in magnetic control: the enclosing cases, bases, and terminal, wiring, and conduit devices. Standard magnetic control devices such as fuses, switches, overload relays, and both instantaneous and time-delay relays will be found on many electronic panels. These devices usually perform starting or protective functions and operate infrequently. This infrequent operation sometimes leads to special maintenance problems.

Trouble	Cause	Remedy
Loose Connection, or Leads Breaking	Excess vibration.	Install extra-flexible connections.
Reduced Tube Life, or Tube Failure	Vibration or mechanical abuse.	Shock-mount the control panel and use extra-flexible leads. Prevent objects from striking tube holders and sockets. Elements may be jarred out of position or the weld on leads may be broken.
Warning: Tube filament or heater circuits may be at high voltage above ground. Use extreme care in making measurements and adjustments.	Natural deterioration. Usually failure is due to gradual loss of electron emission as the active cathode material is used up or flakes off.	Be sure deterioration is at a rate consistent with expected life for each type of tube in its particular service. If the tube life seems too short, see following recommendations.
	Incorrect voltage on filament or heater.	Check voltage at tube terminals frequently to determine nature of error. Do this with tube in socket both with and without anode lead connected.
	If voltage is: Fluctuating (more than plus or minus 5 percent from rating) Consistently high or consistently low	Install voltage regulating transformer. Adjust taps (if any) on transformer, or install new heater transformer, or install auto or booster transformer to correct voltage.
	Erratic—on and off	Check wiring from heater supply to tube sockets for loose connection or break.
	Ambient temperature too low or too high.	Provide extra heat or forced air cooling to hold temperature within limits specified in tube instructions. Ambient temperature should be measured at the tube. Consult tube instruction sheet before applying cooling means.
	Excessive loading. Operators may have increased anode voltage, replaced coils, or made other changes to obtain greater output. Too frequent operation.	Tube should not be operated at outputs greater than those for which it has been designed. When equipment is used intermittently, tube life may be increased by leaving cathodes heated during unloaded periods. This prevents strains caused by too frequent heating and cooling.

TROUBLE SHOOTING CHART (Con't.)

Trouble	Cause	Remedy
Mercury-Vapor Tubes Don't "Fire"	Ambient temperature too low.	Measure air temperature next to tube; provide heat to bring temperature up to value specified in tube instructions. Manually or thermostatically controlled strip heaters are recommended.
Arc-Backs After Tubes Have Warmed Up	Ambient temperature too high.	Provide forced-air cooling according to instruction sheet on tubes. (Mercury-vapor tubes are rated on the basis of "condensed mercury temperature".)
Arc-Backs When Tube Is First Placed In Service	Mercury vapor splashed on elements during shipment or handling of tube. Tube not kept in upright position.	Heat the tube cathode to distill this mercury before anode power is applied. Make sure cathode is heated for the length of time stipulated in instructions furnished with tube.
Failure of Tubes to Operate When Starting Equipment	Interlocks or protective control devices not operating properly.	Check contacts to see that they close and that they are clean.
	Cathode protective timer has not completed its timing cycle.	Wait until timing cycle is completed before attempting to operate equipment.
	No voltage at control panel terminals.	Check external connections to be sure they are correct.
		Check fuses.
	Incorrect power.	Check panel connections to be sure they are right.
	Missing connection.	Check the terminal voltage to make sure it corresponds with nameplate rating.
Overheated Transformer or Reactor	Tubes will not heat up.	Recheck the circuit with wiring diagram.
	Tubes may have been damaged internally through shipment.	Check with wiring diagram to make sure tubes are in the right places. The thyatron tube will be warm when cathode is heated. Do not touch metal power tubes while power is on the panel.
		Replace tube.
Overheated Transformer or Reactor	Overload.	Check cause of overload and remove.
	Defective unit.	Warning is usually given by the odor of excessive heating, melting of the sealing compound, smoking or charring of the insulating paper. Replace transformer.

Equipment for Testing Circuits

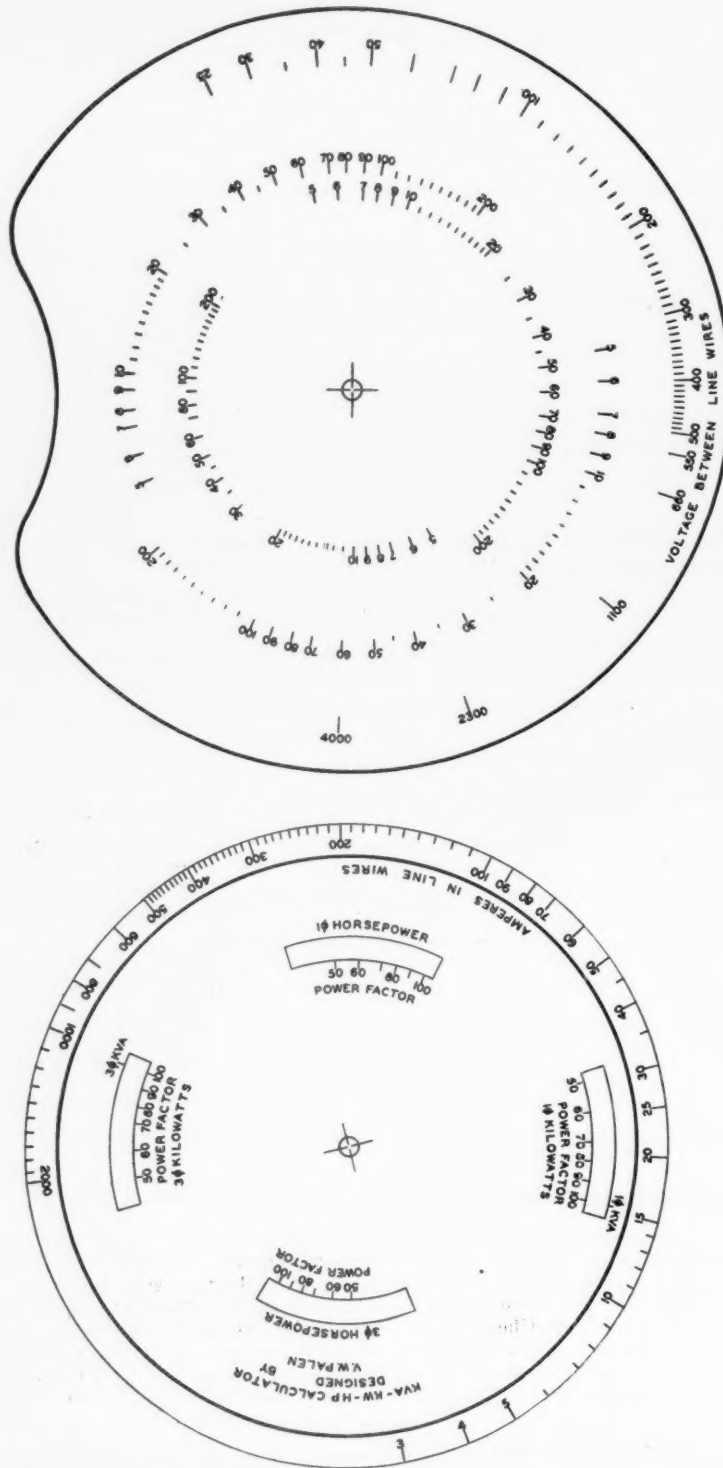
Since many circuits on electronic panels have a very high impedance, in order to properly service this equipment, meters having high impedance are required. The radio-service multimeter, having a resistance of 1000 ohms per volt or higher, is a useful tool, but some circuits can be tested only with electronic instruments such as the vacuum-tube voltmeter (Volt Ohmyst or similar), or the cathode-ray oscilloscope. The cathode-ray oscilloscope, particularly when modified to read d.c. potentials, is an extremely useful device because it combines a very high impedance voltmeter with a time axis, thus voltage changes that are much too rapid for the ordinary instrument to follow are made visible. Instantaneous thyatron grid and plate potentials can be observed easily, and any incorrect operation can be quickly detected.

Information obtained from
General Electric Company

KVA-KW-HP CALCULATOR

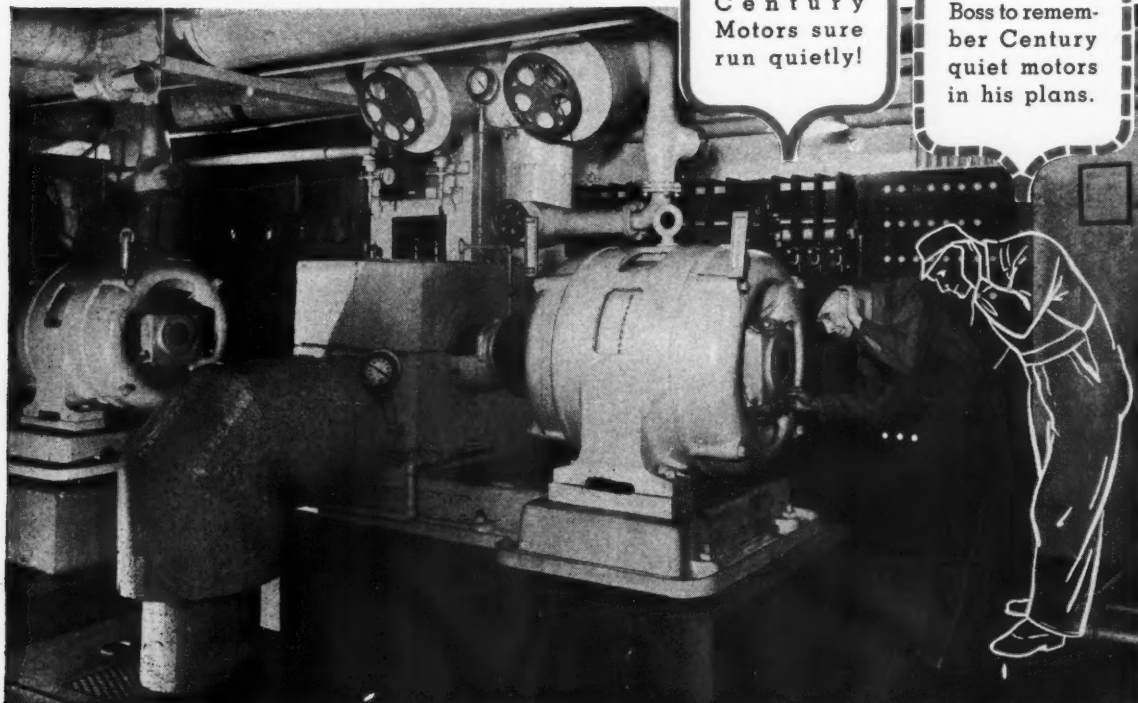
This useful calculator will save the electrician much time in making routine calculations involving electrical capacities. It will solve both single and three phase problems. The calculator range of 5 to 200 (kva., kw., or hp, as the case may be) can be extended to 50 to 2000 by multiplying all values by 10. Kva., kw., or hp. can be found from known

values of volts and amps. Amperes can be found from given values of volts and kva., kw., or hp.; thus wire size can be determined quickly. From terminal amps, the calculator will give kva. load carried by transformer. Carefully reproduce discs, mount on cardboard, cut out. Punch center holes carefully and assemble.



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Boss to remem-
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quiet motors
in his plans.

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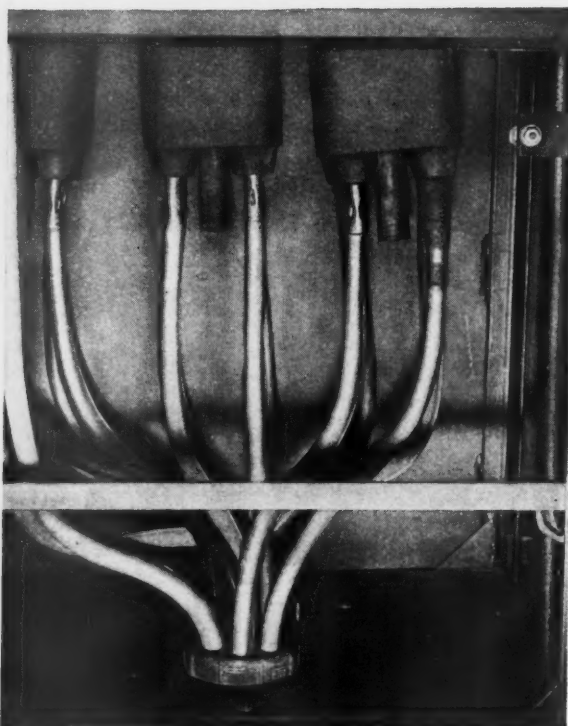
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W side of 4150 volt distribution transformer showing connections of one the three 208-volt ring mains, in the Bell Telephone Laboratory cellar. This is a 3-phase 208 volt 4-wire system with a pair of circuits passing through each "crab" joint (one phase per terminal). The 4/0 Awg Okolite-Okoprene cables are colored blue, red, and black for phase identification. The two white cables on the left are the neutral conductors. 16 cables are connected to the crab joint with mechanical squeeze connectors. One of the conductors is in the process of being terminated.

When Bell Telephone Laboratories decided to decentralize part of their engineering facilities by moving into the country, they determined that their new buildings would be built to last "for at least 99 years."

Taking advantage of their own extensive laboratory experience and test results, they wrote specifications that they knew would provide the most durable materials and equipment available.

Their wiring specifications, for instance, called for an oil-base compound protected with a neoprene sheath, where exposures required it. In this new laboratory it was essential to have insulated wire that would resist flame, moisture, heat and chemicals.

The accompanying illustrations show how Okolite-Okoprene cables fitted into the picture and how simple it was to install and splice this carefully-chosen wiring. Okolite-Okoprene cables are used in many other places — in central stations, on railroads, in industrial plants, mines, or wherever long-life and full protection is required and they cost no more than high quality-braided wire. Bulletin OK-2009 describes them in detail. . . . The Okonite Company, Passaic, N. J.

Cooperating on this project were:

Architects and Engineers:

Voorhees, Walker, Foley & Smith, New York

Electrical Contractor:

Hatzel & Buehler, Inc., New York City

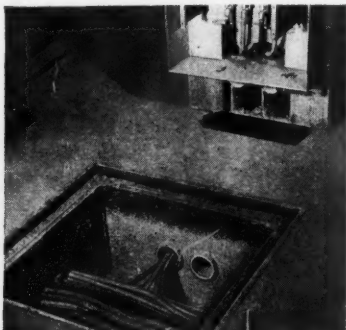
Distribution and Power Cables:

The Okonite Company, Passaic, New Jersey

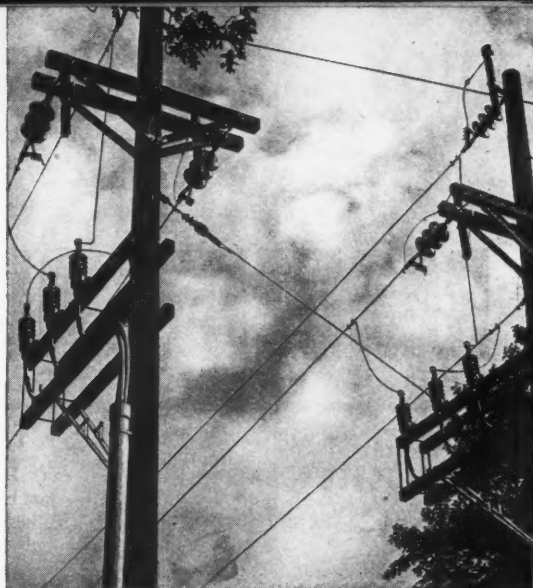




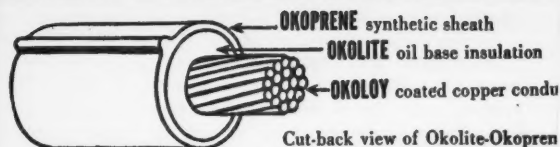
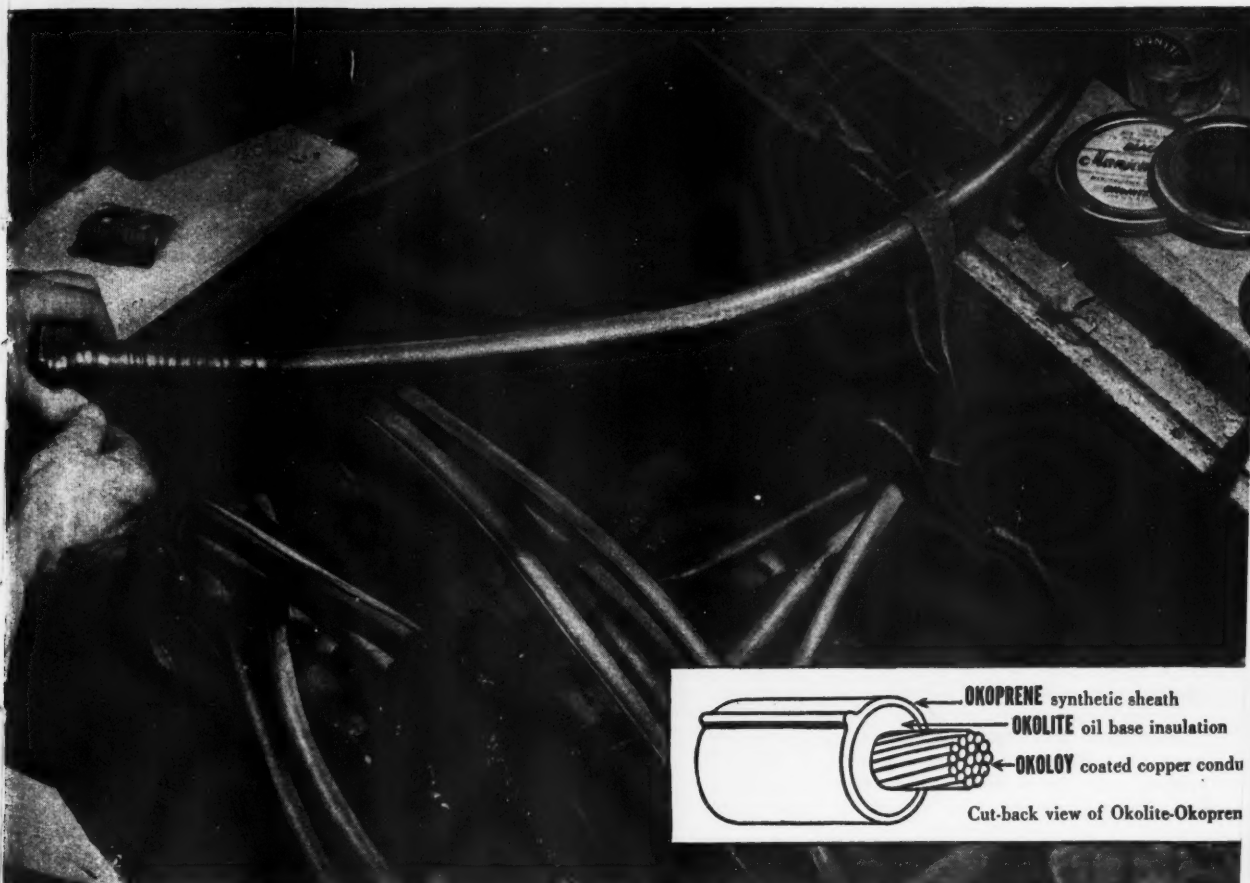
Typical manhole in 4150 volt power distribution line running from substation to Bell Telephone Laboratories. 6 cables on right are 2 circuits of Okolite 3/0 awg 11/64" Okolite 4150 volt lead-covered cables supplying power to distribution transformers in laboratory. 2 cables on left are each 7-conductor Okolite-Okoprene signal cables for operating signal light on control board in main building to permit checking position of substation breakers.



3' x 3'—Distribution manhole and distribution panel in cellar of Bell Telephone Laboratory. 14—4/0 Okolite-Okoprene cables pass through each manhole—each phase and the neutral are tapped by means of a special split tee-connector. Tap circuit can be seen leaving manhole and entering 203-volt distribution panel. Manhole is carefully waterproofed and cover sealed with a gasket.



Terminal poles on Jersey Central Power & Light Company's main feeder line (13,200-volts) serving Bell Telephone Laboratories substation. 6-single conductor Okonite Varnished lead-covered pole riser cables run from pothead terminals through 4" conduit to substation main line breakers.



3' x 3'—Distribution manhole in Bell Telephone Laboratory cellar showing taps being made on 208-volt ring main distribution cables. These are 4/0 Okolite-Okoprene cables colored for phase-identification. Splicer is making final tap with special split tee-connector. Exposed section of conductor and connector are insulated with Okonite rubber tape and pro-

tected with layers of Manson Tape and finally painted with weatherproof compounds. Okolite-Okoprene cables were specified for use in the following tough, damp locations: (1) under cellar floors, (2) between buildings (3) to street lighting standards, (4) at substation, (5) wiring in kitchen refrigerators, (6) all wiring to outdoor bracket fixtures.

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

READER'S QUIZ

INTERLOCKED CONTROLS

QUESTION 110. I would like a wiring diagram for the following group of motors: We have a group of eight 220 volt, 3 phase, 60 cycle motors we want to interlock. Motors Nos. 1 and 2 are controlled by manually operated starters. Motors Nos. 3 to 8 have magnetic starters.

I would like to arrange the control so that motor No. 8 must start before any of the motors Nos. 1 to 7 can be started.

If any of the motors Nos. 1 to 7 should stop, all except No. 8 must stop. If No. 8 should stop all others must stop.

Motors Nos. 6 to 8 are operated by start and stop buttons. The nub of this problem is, of course, the operation of motors 1 and 2 which have manual starters.—R.E.P.

A. TO QUESTION 110. R.E.P. does not specify whether motors 1 to 7 are to be started independently, simultaneously, or in sequence. I am assuming the motors 1 to 7 are to be started independently after motor No. 8 is started. Also, I have assumed all the motors as across-the-line type motors. On the wiring diagram I have omitted the safety switches in order to simplify it. Motors 1 and 2 will have to be changed over to magnetic starters.

As shown in the diagram, motor No. 8 is connected in the usual manner. From the load side of the interlocking contact, one wire is connected to the line side of the interlocking contact of

starters 1 to 7 and also to one side of the start button for each of these motors. The other side of the interlocking contact and start button are both connected to one side of the operating coil. The other sides of the operating coils are all connected in parallel and then connected to the stop buttons and overload relay contacts which are all connected in series, so if one motor stops all motors 1 to 7 stop, and then to line L3.

Part of the wiring on the existing starters will have to be removed or changed. These changes are not shown as they vary with different starters.

If motor No. 8 stops, its interlocking contact is opened, thus opening the line to the other operating coils so they also will shut down.—D.C.C.

A. TO QUESTION 110. As stated in the question, the real problem is the method of controlling the two manual starters in order to stop their respective motors in case one of the

other motors should stop operating.

The diagram below shows contacts and operating coils only, no thermal elements or motors being shown.

The two manual starters are connected to No. 7 magnetic starter on the load side of the contacts but on the line side of the thermal elements or overload protection.

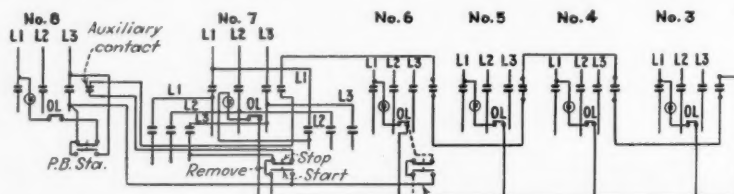
The operating coil of No. 7 starter is disconnected from the starter and receives its power from the load side of the L1 line of No. 1 manual starter.

The other end of the maintaining circuit terminates on the load side of the L3 line of starter No. 2.

It follows that both manual starters must be closed in order to complete the maintaining circuit.

Note that the L1 line of No. 1 manual starter is connected to the hot L1 line of No. 7 starter but on the load side of the disconnect switch.

It will be seen that all auxiliary starter contacts are disconnected from



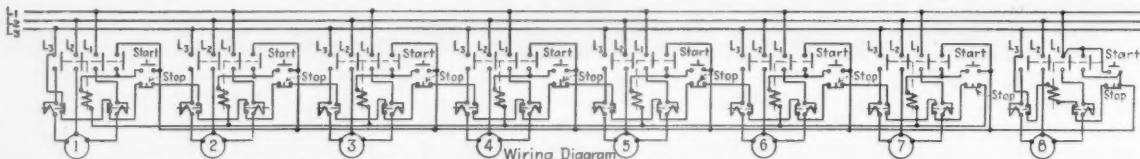
All auxiliary contacts must be disconnected from starters. No. 7 starter to be capable of carrying its own motor load plus motors operated by manual starters. Manual starters to be connected on load side of No. 7 starter but on line side of thermal elements.

To Operate:-

1. Start motor 8 with push button
2. Close No. 1 and No. 2 manual starters
3. Press No. 7 starter push button and hold closed until all motors have started

This P.B. station can be wired as shown by dotted lines and remove solid wire from O.L. but you would have to press two buttons at the same time. Would prefer leaving it out and wire as shown.

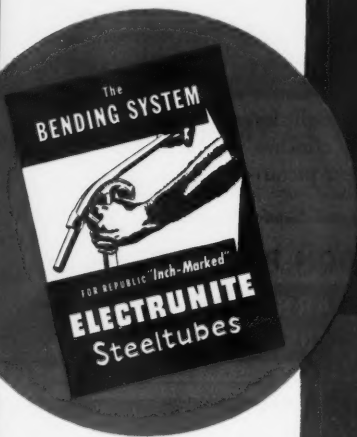
In case you are not permitted to start motors 1 to 7 inc. at the same time it will be necessary to install time delays between starters 3-4-5-6 & 7



Motor No. 8 must be started before motors No. 1 to No. 7 can be started. Then any of motors No. 1 to No. 7 may be started. Stopping of any one of motors No. 1 to No. 7 stops all motors except No. 8. Stopping No. 8 motor stops all motors.

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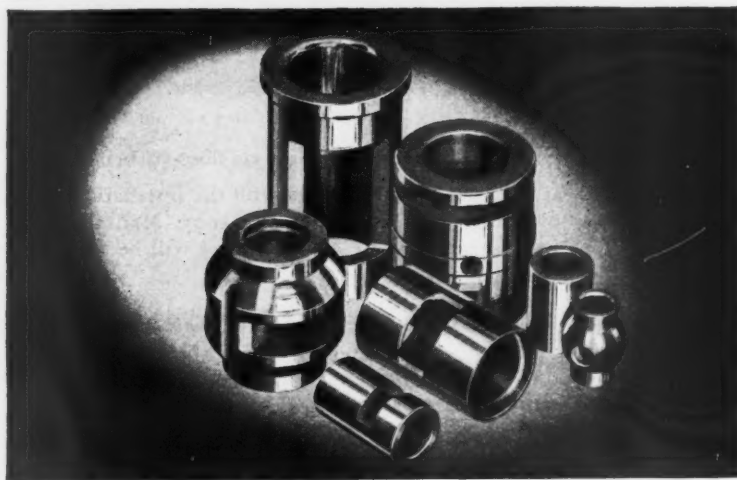
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their respective magnetic starters and that all of them are in series in the maintaining control circuit. Therefore, no matter which starter opens, Nos. 3 to 8, the auxiliary contact will open and stop all motors influenced by the maintaining circuit described above.

In case No. 8 motor starter opens all motors will stop, but if one of the starters 1 to 7 opens only motors 1 to 7 will stop.

If the magnetic starters with push-buttons have the stop and start buttons in the cover, the wiring must be changed to coincide with the diagram.

The only change in the wiring of No. 8 pushbutton is to disconnect the lead from the auxiliary contact and connect it to the load side of the L3 line.

The No. 7 pushbutton is disconnected from the starter and the jumper removed as indicated on the drawing.

Since motors 1 to 7 are to be prevented from starting unless No. 1 motor is running, the control wire for starting must be connected on the load side of the L3 line of No. 8 starter.

When starting from standstill since all auxiliary contacts are open, they must be short circuited during the starting period.

This is accomplished by connecting one terminal of the No. 7 "start" button to the load side of No. 8 L3 line and the other terminal of the "start" button to the line which is common to all operating coils except the operating coil of No. 8 starter.

The operating instructions are:—

1. Start No. 8 motor by closing the start button of No. 8 starter.
2. Close manually operated starters Nos. 1 and 2.
3. Press start button on No. 7 starter and hold closed until all starters 3 to 7 are closed.

When all starters are closed, the maintaining circuit is complete from the load side of No. 1 starter L1 line through the No. 7 starter operating coil then to a common line to operating coils on starters 3, 4, 5 and 6, the common line continuing through auxiliary contacts on starters 3 to 8 inclusive then through the maintaining stop contacts to the load side of starter No. 2 L3 line.

In order to prevent the necessity of pressing more than one pushbutton I would remove No. 6 starter pushbutton from the circuit.

If used, it should be connected as shown by the dotted line in which case both the pushbutton on No. 7 starter and the one on No. 6 starter must be closed and held closed during the starting period.

Should the power company limitations prevent the starting of motors 1 to 7 at the same time, time delays can be installed between the magnetic starters.

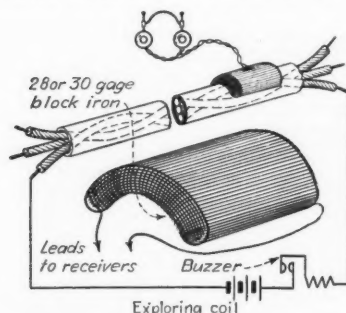
A simple way to prevent all motors

from starting at the same time would be to install snap switches in each line running to the overload trip (marked O.L.) have them all open when starting and close one at a time as the motors come up to speed. This is not foolproof however as one would have to remember each time to open the snap switch before starting. Furthermore, the power company would not allow this if their limitation prevents the starting of motors 1 to 7 at the same time. Perhaps the only case the snap switch system could be used is where one owns his own generating station.—B.A.S.

TESTING A MULTIPLE LEAD-COVERED CABLE

QUESTION 111. How can a multiple conductor lead-covered cable be tested in a manhole where many cables are carrying high voltage, before cutting said cable for changeover?—E.C.C.

A. TO QUESTION 111. A multi-conductor cable can be identified among other cables in a manhole by passing an interrupted signal current through one conductor of the cable in one direction and returning to the source via ground or preferably by an



underground metallic conductor that does not pass through the same manhole. The cable carrying the signal current may be picked out with an exploring coil connected to a pair of receivers and passed along the cable.

The signal current can be supplied by batteries and buzzer if more elaborate equipment is not available. See sketch above.

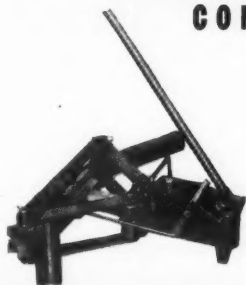
Most repairmen prefer to pike the cable after it has been identified by driving a pointed $\frac{3}{8}$ -in. steel bar through the lead sheath into the conductors. The bar is long enough that the piking operation can be done without entering the manhole. Rubber gloves should be worn by the person doing the piking.—B.C.M.

A. TO QUESTION 111. The lead-covered cable could be isolated in the manhole as follows:

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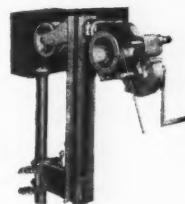
There's a Greenlee Bender for any of your bending jobs. Small hand benders and powerful hydraulic benders for conduit, pipe, and tubing from $\frac{1}{4}$ to $4\frac{1}{2}$ -inch size. Greenlee Hydraulic Benders are easily operated by one man . . . save the cost of many manufactured bends and fittings . . . are compactly built in one unit . . . and are easily carried to the job and set up. The No. 770 Bender, shown here, will bend $1\frac{1}{4}$ to 3-inch pipe while the No. 775 Bender will handle 3 to $4\frac{1}{2}$ -inch material.

NO. 765 CABLE PULLER

KNOCKOUT TOOLS

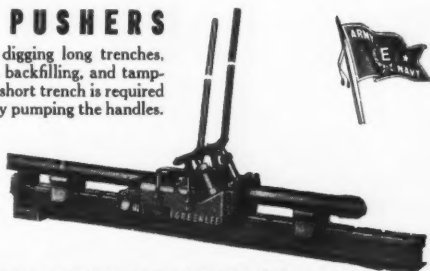
Greenlee Knockout Punches and Cutters will enlarge holes in metal up to $\frac{1}{8}$ -inch thick without long tedious drilling and filing. A Knockout Cutter or Punch is inserted in a knockout or a small drilled hole, a few turns of the drive nut with an ordinary wrench, and a hole up to $3\frac{1}{2}$ inches can be cut in $1\frac{1}{2}$ minutes or less.

The Greenlee Cable Puller will save many hours of work when pulling in cable. This handy tool clamps right on to the conduit through which cable is pulled . . . is easily carried to the job . . . can be set up in a jiffy . . . and is easy for one man to operate with one or two hand cranks. This cable puller, with a maximum pull of 7500 pounds and with two speeds, can be clamped to 2 to 5-inch conduit.



HYDRAULIC PIPE PUSHERS

Greenlee Hydraulic Pipe Pushers eliminate digging long trenches, tearing up lawns, breaking through concrete, backfilling, and tamping when installing pipe underground. Only a short trench is required and one or two men can easily push the pipe by pumping the handles. The No. 790 Pusher will push pipe from $1\frac{1}{4}$ to $4\frac{1}{2}$ -inch size while the No. 795 Pusher will handle large drainage ducts, concrete sewer pipe, and pipe beyond 4 inches.



SEND FOR NEW GREENLEE CATALOG 33-E

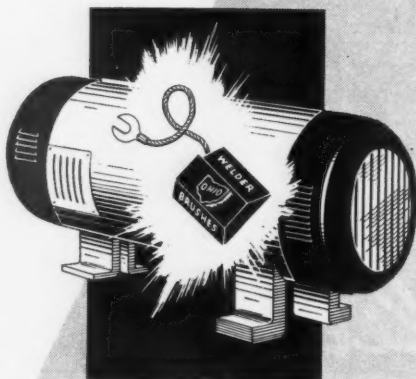
Write for free copy of this valuable reference and buying guide to the complete line of Greenlee Tools for the Electrical worker.



1750 COLUMBIA AVE.
ROCKFORD, ILLINOIS

Greenlee TOOL CO.

Welder Brushes



**ORDER THE
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FROM
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Manufactured by OHIO CARBON COMPANY

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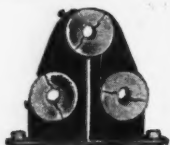
2127 Pine St., St. Louis 3, Mo.

30 Trowbridge Ave., Detroit, Michigan

289 Simpson St., N. W., Atlanta, Georgia

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SIMPLICITY PLUS!
**New NON-INDUCTIVE
CABLE RACK**
for
**INDUSTRIAL
PLANT
WIRING**



Type D-F 3-Conductor Cable Rack, New Non-Inductive Design. Racks available for Cable sizes from 5/16" to 2 1/2".

● Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction. . . . Installation of cables made quick and easy through the use of split bushings.

Send today for Bulletin C-S-51 which illustrates the complete line.

**THE M. & W. ELECTRIC
MANUFACTURING CO., INC.,**
EAST PALESTINE, OHIO

**KEEP
THE WHEELS
TURNING**
WITH **TRICO**
**Automatic
OILERS**

No need to stop production to oil machines—no bearing failures due to lack of oil—no waste. Modernize your equipment and conserve critical materials, man-power, and increase production. **INSTALL TRICO AUTOMATIC OILERS!**

**TRICO
KLIPOKs**

Lock like a vise!

They eliminate:

- Unnecessary shutdowns
- Premature fuse blowings
- Destroying temperatures
- Wasted current
- Night and holiday repairs

Install KLIPOKs everywhere.



WRITE FOR BULLETIN No. 6

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

Have both ends of cable off bus or disconnected from source of supply and its load.

At one end connect a source of d.c. current such as a generator, or battery etc., connect one leg of the d.c. to one of the phases of the conductor which you wish to isolate, through a 5 or 10 ohm resistance. Connect the other leg or generator to ground.

Ground the other end of the conductor making sure to get the same phase which the d.c. current is on.

Connect an interrupter in series with the leg of the generator (that goes to the conductor), and the conductor. This interrupter should work at about two seconds on and two seconds off. The reason is that the person trying to locate the feeder will know the feeder when he sees the deflections.

The person in the manhole should have a galvanometer with coil connected so as to pick up the field set-up in the cable by the d.c. As the interrupter makes and breaks he will see the deflections.

The person testing for the feeder holds the coil of the galvanometer against the sheathing of the cable, and goes from one cable to the next until he picks up the one that gives him the deflections.—J.D.A.

A. TO QUESTION 111. Connect a two ampere load between one hot lead of correct cable and a ground. This will cause a clamp type ammeter, placed around the cable, to indicate the magnetic leakage through the cable. Of course, the supply transformer must be grounded.—H.S.

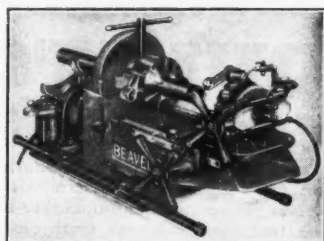
CHARGING A SINGLE CELL

Q UESTION 112. I have an Edison nickel-iron-alkaline storage cell type A-6 used with an instrument to measure low values of resistance and have quite a problem charging this cell. A 60 minute charge at 90 amperes is recommended for boosting, but a rate of 45 or more amperes is normal.

We have several sources of direct current at 600 and 125 volts, but no practical means of using it for this purpose. On several occasions I have put this cell in series with a synchronous motor field with the proper current, but due to the necessity of shutting down to make the connections it is not a very desirable method.

Can you suggest a method of getting 90 to 100 amperes direct current at 1.5 and 2 volts?—E.J.K.

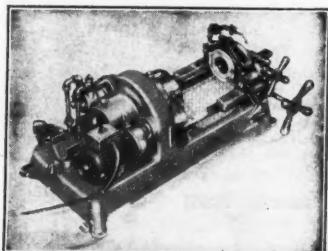
The A-B-C of . . . Pipe and Bolt Machines!



Beaver Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range 1/4 to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts, 1/4 to 2-inch. Wt. 415 lbs.

Write for Bulletin A



Beaver Model-B

A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range 1/8 to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1 1/2-inch. Weight 280 lbs.

Write for Bulletin B



Beaver Model-C

A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from 1/4 to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1 1/2-inch. Two men can work at the same time without interference. Weight 150 lbs.

Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

BEAVER PIPE TOOLS

1042 Deen Ave. Warren, O.

A. TO QUESTION 112. One method of obtaining the normal charge of 45 amperes at 2 volts would be to use a rheostat in series with the cell. The necessary resistances can be determined by use of the formula $R = \frac{E - Eb}{I}$. R = resistance; E =supply voltage. Eb =cell voltage; I =charging current. For the normal charging of 45 amperes, the resistance necessary would be 2.73 ohms. For "boosting charge" of 90 amperes the resistance necessary would be 1.36 ohms. The rheostat should have resistance steps from 1.36 ohms to and including 2.73 ohms; the ability to carry 90 amperes for one hour and dissipate 11 kw. of power.

From the above you can see that to charge the one cell direct from the 125 volt supply is very inefficient and expensive.

I would suggest the possible use of low-rate charging, using perhaps an automobile or truck generator. The Edison Storage Battery Company recommends the following formula to determine proper current for trickle charging.

$$\text{Current} = \frac{(\text{amp.-hr capacity}) \times 0.16 + 1}{(\text{amp.-hr use l per day}) \times 1.10}$$

24

—V.M.

A. TO QUESTION 112. I solved a similar problem with an old automobile starting motor converted to a shunt generator. It is very simple to get in excess of 200 amperes.

The four series field coils were removed and four shunt coils were wound and installed with a heavy duty slide wire for a shunt field rheostat.

The generator was then connected to an 1800 r.p.m. 1.5 hp. motor with a short piece of hose and suitable clamps. I calibrated an external shunt to a zero center automobile ammeter giving it a multiplier of 10. The armature requires no change. You will find it very simple to make this m-g set and that a hit and miss design will produce the required results necessary for the intermittent duty required.

The efficiency will be very low but you can make a rugged charger for this application with a very small investment.

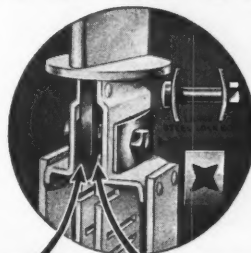
Remember that for a fixed connection only one rotation will cause a self-excited generator to build up and once this is determined you cause it to generate either polarity by establishing a residual flux in the desired direction.

The Edison cell practically thrives on abuse, therefore you can discharge this cell back through the machine as a motor.—J.J.

A. TO QUESTION 112. Since the method of charging by means of



WARE HI-LAG



LINKS LOCKED INTO CIRCUIT

NON-HEATING CONTACTS

Keep Motors Humming



100% Quality

APPROVED BY UNDERWRITERS

WARE BROTHERS

4410 W. Lake St.

Chicago, Ill.

WARE

Renewable
HI-LAG FUSES



**"To keep away
from Rust...
To keep wiring Safe..."
Engineers are still
specifying..Sherarduct
Rigid Steel Conduit...**

**National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.**

placing the battery in series with the synchronous motor field was satisfactory, except for shutting down the motor to make the connection, this method may be continued. It is necessary only to provide a convenient means of making the connection.

This can be done by placing a single pole knife switch (of say, 200 amp. capacity) in series with one lead to the motor field and placing an additional, convenient type, solderless connector on each terminal of the switch. These connectors can be marked according to their relative polarity, plus and minus.

When battery requires charging, it is connected to the proper terminals on the switch, and the switch opened; when charging is completed, the switch is closed and the battery disconnected.

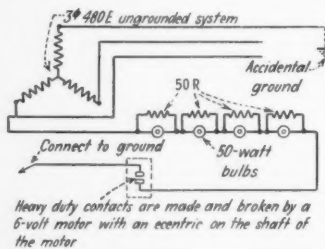
The entire operation is thus accomplished without interruption to the motor.—E.S.

Can you ANSWER these QUESTIONS?

QUESTION K4—We have a group of six $\frac{1}{2}$ -hp. squirrel cage, induction motors, 220 volts, 60 cycles, 3 phase. All of these motors are connected to the same feeder, but drive different machines. These motors were stopped and when restarted one of the machines was reversed. I made a test of all fuses and all of them were good. What could have caused this one motor to have reversed?—R.E.P.

QUESTION L4—It would be appreciated if someone could give me an accurate method of locating accidental grounds on 480 volt, 3 phase ungrounded system, which covers an area of five square blocks, while the system is energized.

At present we induce a signal out on the system and by earphones and exploring coil we pick up the interrupted signal, but on



a well loaded system with the multiplicity of the sheath grounds and 60 cycle hum, it is hard to distinguish the interrupted signal especially if it is a high resistance ground.

The above is a diagram of the present testing circuit.—L.R.T.

**PLEASE SEND IN
YOUR ANSWER BY NOVEMBER 1**

Fixture Hanger and Reflector PYLETS

For dependable lighting installations get the substantial construction of Pylets, plus convenient and labor-saving features that save time on the job. Pylets offer you a range of choice that covers all requirements of industrial plant lighting, including mercury vapor, reflector, fluorescent fixtures, explosion-proof and dust-tight types for hazardous locations. Write for your copy of Pylet Catalog 1100 with complete listings of all types.

ROC SERIES

lighting fixture Pylets for ROC reflectors. Also with mounting flange, ROF Series. Can be furnished with hooks for messenger wire suspension.



AL SERIES

threaded flexible fixture hanger Pylets, allows fixture to swing. Also cushion style which absorb vibration.



UF SERIES

flexible fixture hanger Pylets, heavy duty sealed type, for protection against dirt, gases, and moisture.



HOOKS and LOOPS
for messenger wire suspension of pendant fixtures. Also suspension hangers and conduit clamps.

VAPORTIGHT

fixtures—all types for surface, outlet box, hand-rail, wall mounting; single, two and three gang, for lamps 10 to 200 watts.



The Pyle-National Company

**1344 North Kostner Avenue
Chicago, Illinois**

on the conveyor, he places the stick upright or not depending on destination.

As the material moves along, passing intersections, entering into and unloading from the elevators and proceeding to its destination, collisions are avoided by interlocking and lockout limit switches, and relays. Several pallets may arrive at different levels at the same elevator at the same time. However, the one hitting its "call" limit switch first, gets the elevator and at the same time locks out all other calls. The lockout is cleared on unloading by actuating another limit switch, allowing the elevator to call for the next in line.

The accompanying photographs and wiring diagram are in connection with an intersection where one conveyor line emerges into two. If the pallet moving along the line is provided with an upright, the light beam from the source to the photoelectric cell is interrupted. Referring to the wiring diagram, the holding coil of the photoelectric cell relay (which is connected reverse) is energized and contact No. 1 is closed momentarily. The holding coil of the auxiliary relay is thereby energized closing contacts Nos. 2 and 3. Contact No. 2 keeps the relay holding coil energized through the normally closed contact No. 4 of limit switch No. 1.

The closing of contact No. 3 energizes the magnet coil of the chain transfer breaker. As the transfer chains move around, parallel lugs carry the pallet across to a position where it may unload onto the other line. When the pallet reaches the end of its cross travel, limit switch No. 1 is actuated, closes contact No. 5 and opens No. 4. Opening No. 4 de-energizes the auxiliary relay thereby opening contacts Nos. 2 and 3, dropping out the chain transfer.

Closing No. 5 momentarily, energizes the magnet coil of the breaker for the belt conveyor which unloads the pallet from the transfer point. Thus the pallet is carried out onto the other conveyor line. As it clears the short unloading belt, limit switch No. 2 is actuated opening contact No. 7 restoring the entire control system to normal. Although not shown in the wiring diagram, another limit switch is placed on the approach to the transfer point whereby a following pallet may be stopped if a transfer is in operation.

Idof Anderson, Superintendent of Power for the Norton Company is electrical designer of this traffic system.



TEMP-O-RISE THERMOSTAT

This thermostat embodies two principles in fire detection, one principle working on the rate of rise of temperature for early detection of a fast burning fire. Also the fixed temperature principle for the detection of slow burning and dangerous smoldering fires which cannot be detected by the rate of rise principle until the flash of the accumulated gases—which may be far too late.

By the use of both principles of fire detection, no fire can escape early discovery by this spot thermostat. It is made in four models—

Model #101—Rate of rise and fixed temperature operating at 165° Fahrenheit.

Model #102—Rate of rise and fixed temperature operating at 212° Fahrenheit.

Model #103—Fixed temperature only operating at 165° Fahrenheit.

Model #104—Fixed temperature only operating at 212° Fahrenheit.

Each thermostat covers 30 x 30 feet of ceiling space.

Approved up to 110 volts AC-DC.

We are manufacturers of Underwriters' Approved Fire Alarm products covering the entire field of fire protection. Class A proprietary systems . . . Non-code fire alarm systems . . . all classes of switches and coded transmitters for supervision of automatic sprinkler equipments . . . complete thermostatic fire alarm systems . . . watchman supervisory systems . . . manual fire alarm systems.

Complete plans and instructions furnished for installation, operation, and maintenance. Approved for use by the Army, Navy, and other government departments, also approved by Underwriters Laboratories and Associated Factory Mutual Laboratories.

For information write to

CENTRAL STATION SIGNALS, INC.

71 West 23rd Street,

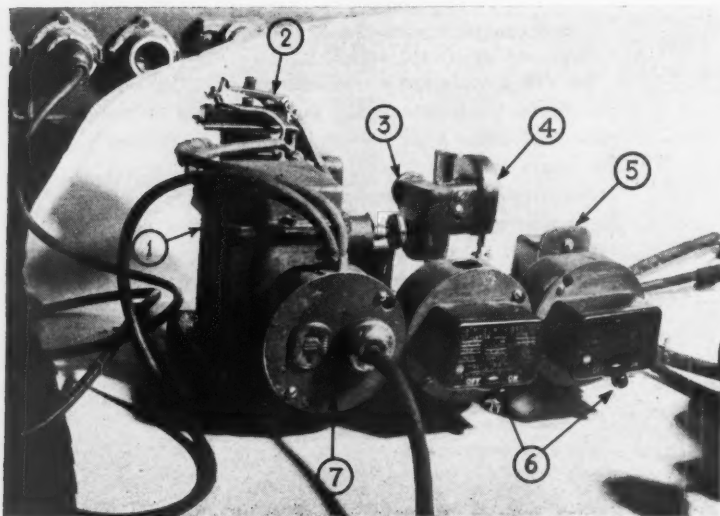
New York 10, N. Y.

MOTOR SHOPS

STARTING TESTER FOR SMALL MOTORS

Small electric motors rewound or repaired in the shop of the Wm. C. Krauth Electric Company Louisville, Ky., must run the gauntlet of thorough routine tests, the same as large units. One of the toughest is the start-stop test given to all split-phase, capacitor and repulsion induction motors up to 1 hp. in size. If the starting winding or mechanism of a repaired motor is going to fail, they make sure it fails while in the shop before delivery and installation.

The testing apparatus that the Krauth organization developed for this check-up is compact, efficient and simple. The heart of the unit is a small 110-volt, 6 r.p.m. gear motor which drives a small 6 to 1 gear reducer. Driven by the gear reducer shaft is a small cam with a vertical arm connected to the lever of an ordinary electric float switch. The cam lever is so set that at its lowest point it will flip the float switch "on"; and "off" at the highest point. Thus the motor on test is started and stopped every 30 seconds—a tougher duty cycle than most small single-phase motors encounter.

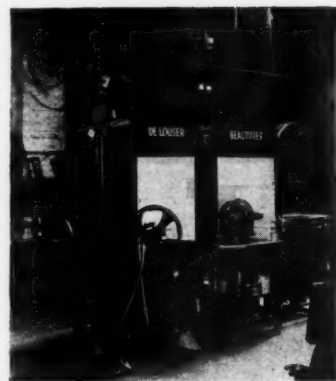


SALIENT FEATURES of this motor starting test set are (1) a 6 r.p.m. driving motor; (2) dashpot relay with signal bell; (3) a 6 to 1 gear reducer; (4) a cam with lever arm operating; (5) an ordinary float switch; (6) overload circuit breakers of 4.0 and 8.5 ampere capacity and (7) convenience outlet for plugging-in test motor.

Ample overload protection for the motor on test is provided by two small Sentinel circuit breakers; one set at 4.0 amperes; the other at 8.5 amperes for larger motors. If these breakers fail to function, a small dashpot relay, set at a slightly higher level will kick out. An ordinary electric bell, operated through a bell ringing transformer and connected to the relay issues a warning if the motor "freezes" during test. Motors can be left "on test" for several hours while other work in the shop is being done.

The motor on test is plugged into a duplex outlet by an extension cord with test clips on one end. The left side of the outlet is connected to the 4.0 ampere breaker; the right side to the 8.5 ampere breaker. Present plans include the addition of breakers of 2 and 6 ampere capacity.

This portable test unit can be plugged into any 110-volt convenience outlet in the shop. The entire assembly is compact and readily portable for use anywhere in the shop. The test set has more than paid for itself in the reduction of call backs attributed to starting device failures on motors repaired in the shop. Now such faults can be detected before the motor is returned to the customer.



BEAUTY TREATMENT for motors at the Mielke Electric Works, Inc., shop in Duluth, Minn., includes a thorough spray cleaning in the "delouser" at left and finish painting in the "beautifier" at right. Bottom of paint spray booth is the top of a portable table which slides into booth. Motor is resting on small turntable to facilitate painting. Fluorescent units give high quality even light distribution in both booths.

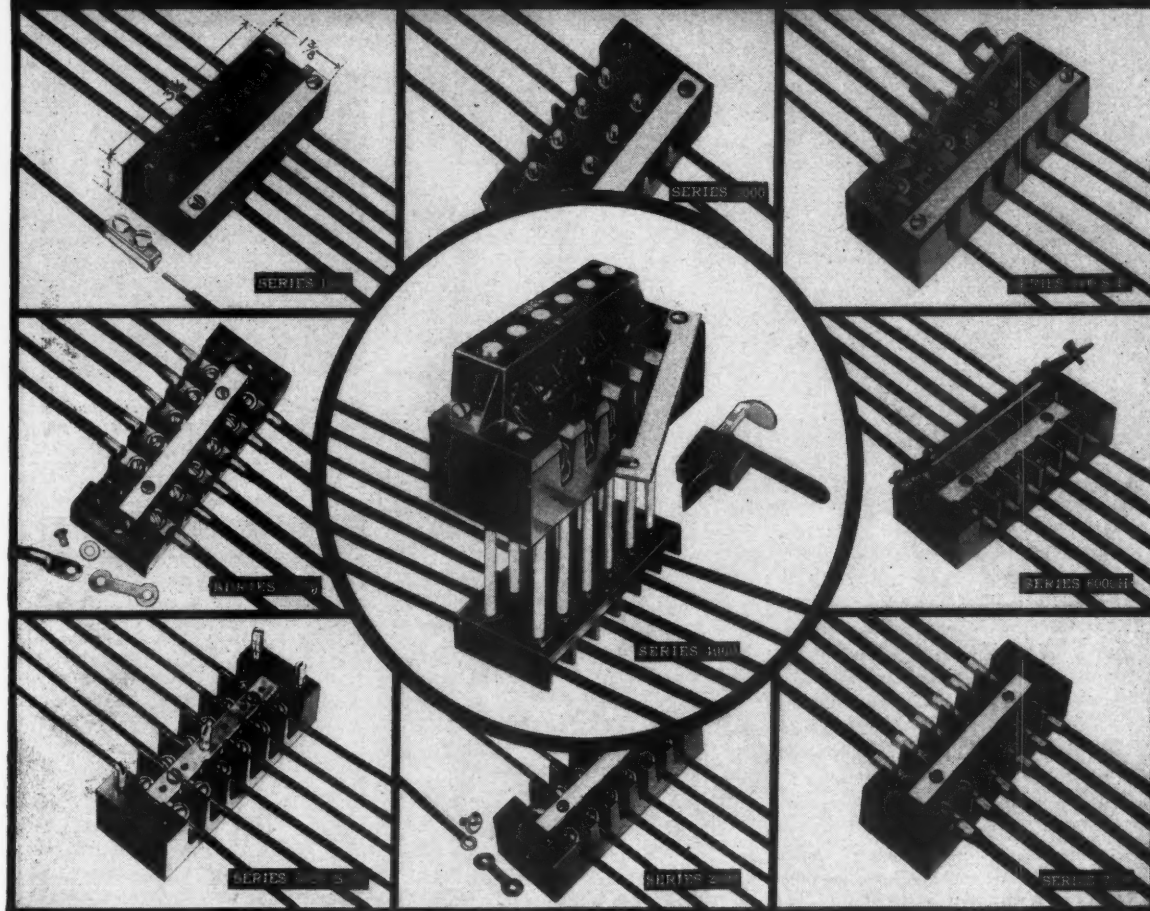
COIL PULLER YANKS 'EM OUT

A table-top coil puller built by the Wm. C. Krauth Electric Company, Louisville, Ky., motor service shop does a clean job of yanking burned out coils from stator slots. In fact, it works well on stators up to 75 hp. in size. Two prerequisites to efficient operation of the mechanism are, of course, that one side of the stator winding be cut away and that the coils be "burned out" to remove insulation and varnish adhering to the copper.

The actual pulling mechanism consists of a 3-inch diameter flanged drum, 3½-inch inside width, keyed to a shaft mounted to the table top. Around this drum is wound a short length of heavy chain, composed of 1-in. by 1½-in. links fastened to the drum at one end and to pulling tongs at the other. Adequate leverage is secured by a 36-inch flat iron handle bolted to a mounting wheel at the end of the drum shaft.

The coil gripping tongs are nothing more than a pair of ordinary gas pliers with handles reinforced by pieces of 1-in. by ½-in. flat iron welded thereon. Fang-type steel gripping tips were welded to the nose of the pliers. The

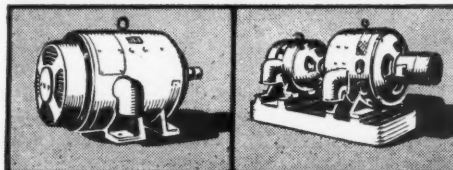
Choose from 10 BURKE TERMINAL BLOCKS



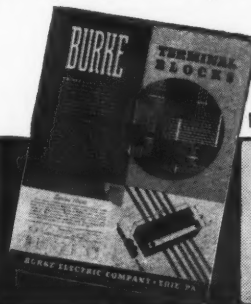
Wherever two or more wires come together there is an application for Burke Controlead Terminal Blocks. They are standardized in 10 types to meet all kinds of applications. Additional moulding capacity

on a 24-hour basis permits faster deliveries to meet urgent war demands. Consult with Burke engineers for correct selection of these high quality blocks for your needs.

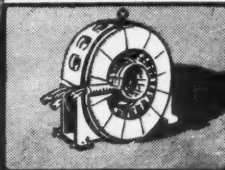
BURKE ELECTRIC COMPANY • 1202 WEST 12TH STREET



D. C. Equipment to 1500 H. P.
and 1000 K. W.
A. C. Equipment to 1500 H. P.
and 1000 K. W.
M-G Sets to 1000 K. W.
Molded Bakelite Terminal
Blocks



Write
for Booklet TB-2
Today
ERIE, PENNSYLVANIA





Every good tool in the hands of American workers is a threat to the Axis. Every tool carelessly used, broken or lost reduces our productive capacity. To help workers get the greatest use from their tools, we have prepared a booklet on the proper use and care of tools. A copy will be sent without charge to anyone requesting it.

TODAY Klein Pliers in the hands of soldiers, sailors and wartime workers are helping speed the day of Victory. When the war is won these same quality tools will aid linemen—electricians—good workmen

everywhere to do their jobs better, faster, more surely.

In a post-war world, the name Klein will continue to stand for the highest quality in pliers and equipment as it has "since 1857."

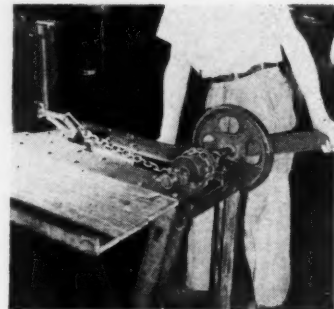
DISTRIBUTED THROUGH JOBBERS

Foreign Distributors: International Standard Electric Corporation, New York

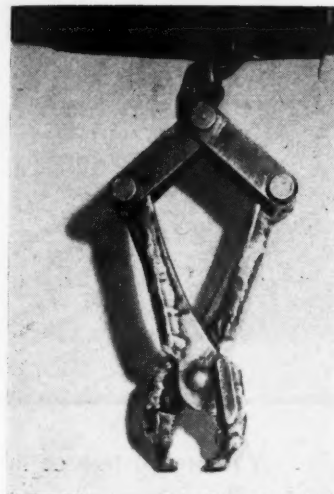
Mathias KLEIN & Sons
Established 1857 **Chicago, Ill., U.S.A.**
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

gripping motion is transmitted to the pliers through pantograph links fastened to pipe collar sleeves welded to the ends of the plier handles.

The table top on which the unit is mounted is 29 inches from the floor and is made of two 4-ft. lengths of 5-in. by 1/2-in. flat iron with a 4 1/4-inch space between for the chain travel. The table legs, forming a modified "A" support, are lengths of 3-in. by 3-in. by 1/4-in. steel angles. Two staunch steel shafts



PULLING RACK for removing burned out coils from motor stators does a clean cut job. A 3-ft. arm on drum shaft provides leverage that challenges the most stubborn coils.



GRIPPING TONGS are fashioned from an ordinary pair of 9-in. gas pliers with reinforced handles and special tips welded to the nose. Pantograph arrangement provides gripping motion.

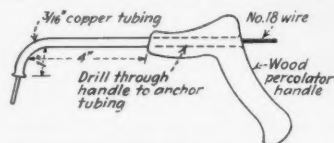
on approximately 5-inch centers form the uprights that hold the stator in place while the tongs do their job of pulling coils from the stator frames.

A wood table extension is added to the pulling table to catch the copper coils as they are pushed aside after leaving the stator slots. The entire unit is adjacent to a copper baling press, so all old copper can immediately be placed in the press and baled for delivery to the scrap collector.

WIRING GUN

When special tools are not handy, John Bartlett of the Sterling Electric Co., Lincoln, Nebraska takes a few minutes to make his own, whether they be simple or complicated. A handy wiring gun is one of the simpler ones that he has developed.

John was faced with the problem of winding a fractional horsepower, 10,000 r.p.m., totally enclosed motor on a portable radial saw. Only one end of the aluminum stator casting was removable.



HANDY GADGET for threading wire in and around small motor stators where fingers turn out to be all thumbs. A piece of scrap copper tubing and an old percolator handle did the trick.

Furthermore, the brushholders were so close to the coil span that it was impossible to feed the wire in with his fingers. The homemade wiring gun was the answer.

A wood percolator handle served as a pistol grip for the gun. A piece of 3/16-inch copper gas line tubing bent and belled at one end forms the nozzle. After the tube was inserted in a long hole drilled in the wood handle it was belled at the other end to prevent it from working loose.

The wire is threaded through the tube, then fed in and around the stator slots, making accessible the hard-to-get-at places. Either the fingers or a small tension device can be used to maintain tension on the wire. This specific gun will accommodate wire up to No. 18 in size.



TAPING MACHINE redesigned by the Mielke Electric Works, Inc., Duluth, Minn., permits coils to be rotated almost 360 degrees in the vertical plane—thus speeding up coil taping. Smaller unit for small coils has same feature. A d.c. drive has variable voltage control.



Answers to Many Pushbutton Control Problems

Cutler-Hammer's New Wide Range Line of Heavy Duty Pushbutton

Stations offers an Unlimited Variety of Functional Combinations

● Now Cutler-Hammer offers a new line of Heavy Duty Pushbutton Stations (NEMA Type 1) for surface mounting and for flush mounting. The surface mounting enclosures

accommodate from 1 to 8 Cutler-Hammer new unitized pushbuttons; the flush mounting constructions accommodate from 1 to 3 C-H unitized pushbuttons. The line provides the widest selection of functions and combinations available today and permits these stations to be "tailored" to your exact needs.

Among the many advanced engineering features are the following: one to 4 circuits for each pushbutton; wide variety of operators; big buttons for gloved-hand operation; projecting shatterproof color caps for 180° visibility; fitted "flange-seal" covers for extra sturdy and tight enclosure; rugged yet light weight construction; ample internal free space for easy wiring despite small size; no sharp corners or edges; excellent appearance; optional padlocking feature. Stations may be mounted horizontally or vertically. Write for further details today. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wis. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

SOME OF THE OUTSTANDING FEATURES OF THIS LINE

Wide choice of operating elements with one to 4 circuits each, indicating lights, selector switches, etc.



Horizontal as well as Vertical Mounting



Fitted "Flange-Seal" Covers

Ample Wiring Space despite Small size

Padlocking Arrangement Available



QUESTIONS ON THE CODE

IRON WIRE

Q. "Can we use stranded insulated iron wire for short runs for the duration?"—H.S.

A. No. The only materials recognized by the Code for conductors are copper and aluminum. See Section 3006.

Of course it is well known that silver has a higher conductivity than copper and thus will make a better conductor—but why worry about that? It's insulated with red tape and has an outer fire proof covering of economy anyway—but to serious consideration of the iron wire, we would find that the high resistance and the magnetic properties of the iron wire would result in excessive heating of it.

NON-METALLIC SHEATH CABLE

Q. "According to Underwriters Laboratories Bulletin No. 43-3 entitled 'Uses and Limitations of emergency wires' Type EI insulation in non-metallic sheath cable limits the use of this material (Interim Amendment No. 69), to barns, chicken houses and dwellings, provided it is run exposed only, for easy removal after the present emergency."

"We, however, carry a type of wire which in our opinion comes under Interim Amendment No. 44, and hence could be used for concealed work, namely in the farm residences with WPB approval."

"Understand, however, that this is only our personal interpretation and we are asking as to whether we are correct in this assumption."—L.E.S.C.

A. Probably the wire which you mention is a non-metallic sheathed cable having rubber insulation on the ungrounded conductor or conductors and weatherproof (WP) insulation on the grounded conductor. The use of the weatherproof insulation on the

grounded conductor is permissible under Interim Amendment No. 44 and such cable can be run either exposed or concealed in accordance with the Code rules in Article 336.

Non-metallic cable, constructed as mentioned above, may be used in many places other than barns, chicken houses and dwellings. It cannot be used, of course, in commercial garages, theatres, motion picture studios, storage battery rooms, hoistways, hazardous locations, breweries, ice plants, cold storage warehouses and similar wet locations as restricted in section 3362.

The interim amendments which put restrictions on types of non-metallic cable in which insulations other than rubber are No. 43, No. 46 and No. 69.

Amendment No. 43 deals with a non-metallic cable having one conductor (the neutral) without individual insulation other than a fibrous covering with its use restricted to "defense emergency buildings". This can be used only with non-metallic outlet boxes.

Amendment No. 46 would permit the use of Type RU (latex), SN (synthetic), RW (moisture resistant rubber), V (varnished cambric) insulation in cable. There will probably be none of this available on account of costs and economic conditions.

Amendment No. 69 permits the use of paper, Type EI, emergency insulation, to be used on the ungrounded conductor of non-metallic sheathed cable which can only be run exposed in dry locations. This is the type of cable which the Laboratories say the reason for the requirement for its being run exposed, is to permit easy removal after the war.

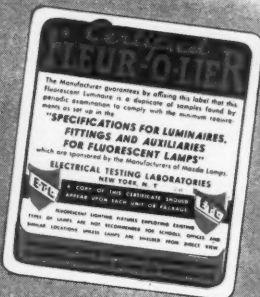
OVERCURRENT PROTECTION FOR BUS DUCT

Q. "Under the present restrictions on the use of metal enclosed bus duct, what does the Code permit in the way of fuse protection when reducing the size of the duct runs? For example: reduction in the size of feeder duct as the load decreases near the end of the run; and breaking off into smaller capacity branch circuit duct runs."—E.A.

A. The National Electrical Code requirements are found in Interim Amendment No. 76, approved Sept. 10, 1942. This provides that "overcurrent protection may be omitted at points where busways are reduced in size provided the smaller busway has a current rating at least one-third that of



ATTENDING THE MERCURY ARC RECTIFIER session at the A.I.E.E. National Technical Meeting at Cleveland are left to right: Joel Tompkins and L. N. Gribs, electrical engineers for the Aluminum Company; C. C. Herskind, General Electric Company; and F. R. Dallye of the Aluminum Company.



Fluorescent fixtures bearing either of these two labels are made to rigid specifications for mechanical, electrical, and illuminating excellence; and are tested and certified by impartial experts, Electrical Testing Laboratories, Inc., of New York. You can depend on fixtures bearing these labels.

Why General Electric recommends Certified Fluorescent Fixtures

GENERAL ELECTRIC Fluorescent Lamps are one of the most efficient light sources of all time.

To make sure that users of these lamps shall receive the fullest benefit from their abundant light, General Electric strongly recommends that they be used in Certified Fluorescent fixtures.

Certified fixtures are made to conform with the rigid illuminating, mechanical and electrical standards—set up under either Fleur-O-Lier or RLM specification programs—and are so certified by the Electrical Testing Laboratories, Inc.

Each of these certified fixtures is so designed that the fixture and the lamps together become a

highly efficient, balanced modern lighting unit.

General Electric is cooperating with many fixture manufacturers—helping to design fixtures for greatest efficiency. And our engineers have aided in setting up the Certification Standards.

One of the benefits of this widespread program is the complete variety of styles and types of dependable fixtures—made available through a large group of manufacturers and distributors.

In the long line of Certified Fluorescent fixtures, your customers can find exactly the styles and designs best fitted to their needs. General Electric Co., Nela Park, Cleveland 12, Ohio.

G-E MAZDA LAMPS
GENERAL ELECTRIC



Dozens TO MEET

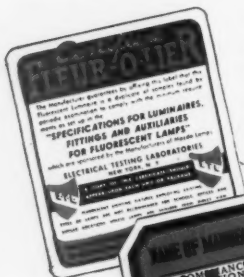
PROMISE NEW ECONOMY

YOUR war-plant customers have individual lighting problems. No two are exactly alike. So the wide choice of styles and designs in *Certified Fluorescent Fixtures* will enable you to meet each customer's exact needs. And by doing that, you will not only be helping the war effort, but will be building good will and friendships for the post-war period.

Many Fleur-O-Lier and RLM manufacturers are making these certified fixtures—some of which are shown here. All of them comply with WPB conservation orders. Each bears a certification tag which is your customer's assurance of efficient, dependable service.

A TRIUMPH OF WAR-TIME INGENUITY. Built to WPB conservation standards, these fixtures are a tribute to the ingenuity of the lighting industry in war-time. Their light weight, their sturdiness, their fine construction would recommend them even if there were no restrictions on materials. And they point the way toward better and better lighting when the war is over.

For some time before the first WPB order, General Electric engineers had been working with fixture manufacturers to develop new non-critical materials for reflectors and new light-weight fixtures. General Electric is glad to have been able to contribute to the research that has made this progress possible.



Fluorescent fixtures bearing either of these two labels are made to rigid specifications for mechanical, electrical, and illuminating excellence; and are tested and certified by impartial experts, *Electrical Testing Laboratories, Inc., of New York.* You can depend on fixtures bearing these labels.



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WARTIME PRODUCTION NEEDS

AND EFFICIENCY FOR THE FUTURE

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Hear the General Electric radio programs: *The "Hour of Charm"*, Sunday, 10 p. m. EWT, NBC; *"The World Today"* news, every weekday, 6:45 p. m. EWT, CBS.



MADE TO STAY BRIGHTER LONGER

Starting with Edison's first successful incandescent lamp, General Electric scientists and engineers have constantly worked toward one goal . . . to make lamps that give more and more light for the current consumed and that sell for less and less money. G-E Mazda Fluorescent Lamps are made to stay brighter longer.

★ *In process of certification when this advertisement goes to press.*

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G-E MAZDA LAMPS





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SAVE MONEY—no breakage or damage to lamps. Changes are made quickly—"slow-up" periods, when lights are out, are shortened—production delays are reduced to a minimum.

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the rating or setting of the overcurrent device next back on the line and provided further that such busway is free from contact with combustible material."

The first part of this Interim Amendment requires that busways have overcurrent protection in accordance with the current carrying capacity of the busses except that where the capacity does not correspond to a standard size or rating of overcurrent devices, the next larger size or rating may be used provided it does not exceed 150 percent of the allowable rating of the busway.

Thus a 1000 amp. busway could be installed and protected by a 1000 amp. circuit breaker and then a 400 amp. busway tapped off from the first one without putting in an overcurrent device; but if a 250 amp. bus was then tapped off of the 400 amp. one, a 250 amp. protective device would have to be provided unless a 400 amp. device had been installed where the 400 amp. bus was tapped off of the 1000 amp. bus.

The carrying capacities of these wartime bus ducts creates a moot question today. Many of the inspection bureaus are sticking to the old rule of thumb rating of 1000 amp. per sq.inch of cross-sectional area of the bus and will not accept the increased rating now being given by the manufacturers. For instance, a bus bar with a cross section of 1-in. by 1/2-in. formerly having a carrying capacity of 250 amp. is now rated by some manufacturers at 400 amp. and in another case a bus 1/2-in. by 3/8-in. was rated at 400 amps. instead of 187 1/2 amps.

The Laboratories now permit a temperature rise of 70 degrees C instead of a former 30 degrees C which naturally results in a higher rating for the bus.

Probably the inspection departments should require the busways to be protected by inherent overheat devices as long as the temperature is the deciding factor.

COMMON GROUNDING CONDUCTORS

Q. "(a) Under the present critical copper situation would it be permissible to use a neutral or system ground for an equipment ground in buildings of wood construction?"

(b) Could these two ground systems be tied in with a lightning ground network?

(c) Would separate grounding systems be required?"—A.E.M.

A. (a) The present critical copper situation does not seem to be involved in this as the Code permits the use of the system ground for also grounding the equipment. Rule 2533 states that "the grounding conductor for circuits may also be used for grounding equipment, conduit and other metal race-

ways or enclosures for conductors, including service conduit or cable sheath and service equipment."

Then Rule 2591a requires that such a common grounding conductor be of copper or other corrosion resistant material without splice and with the conductivity and tensile strength of copper, and Rule 2594 governs the size of such a grounding conductor.

(b) Rule 2586 prohibits using a lightning rod installation for grounding a wiring system, equipment and the like. However, Rule 2534 requires that where metal enclosures of conductors of interior wiring systems cannot be kept at least 6 ft. away from lightning rod conductors, they shall be bonded together.

(c) A grounding system separate from that used for a lightning rod installation is required for grounding wiring systems and equipment.

BLOWING OF NEUTRAL FUSE

Q. "On a 110-220 volt 3 wire, single phase lighting system, is it permissible for a convenience outlet connected to the neutral and one outside leg (110 volt), to receive 220 volts if the neutral fuse blew out?"

The reason I ask this question is that a tenant in an apartment house had his radio damaged beyond repair, apparently through improper fuse protection. An electrician reported that the neutral fuse had blown, thereby throwing 220 volts on part of the building.

Kindly inform me of the conditions which might cause this to happen."—E.W.E.

A. Under the conditions stated above and with a good sized load with its low resistance connected to the opposite side of a 3 wire single phase system and with the neutral fuse blown, the open circuit voltage across the radio, would be 220. Upon closing the radio switch the voltage would drop in accordance with the ratio of the resistance of the radio and the resistance in series with it across the 220 volts.

If the resistance of the load in series with the radio was very low, the voltage across the radio might be close to 220 and sufficiently high to cause damage to the radio. If the resistance of the load on the other side of the neutral was higher than that of the radio, the voltage across the radio would be less than 120 and might be too low to operate the radio.

Of course if the resistance of the radio and of the other load were equal, the two loads would be balanced across the 220 volt each receiving 110 volts and both loads would operate normally.

The Code prohibits fusing the neutral of three wire circuits.

OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

Interpretation No. 246

QUESTION . . . Is it the intent of the Code that the use of infra-red drying lamps with medium screw shell Edison bases be limited to 15-ampere branch circuits in view of the requirement for lampholders of the heavy-duty type appearing in subdivision of Article 210 applying to branch circuits of larger current ratings?

ANSWER . . . No.

NOTE . . . The organization of a technical sub-committee to consider the need for and/or to recommend special Code treatment for industrial heaters employing infra-red lamps is under consideration.

Interpretation No. 247

QUESTION . . . Does the term "effectively grounded" in paragraph (a) of section 2582 require that the metal frame of a building be grounded by some other type of grounding electrode mentioned in the section?

ANSWER . . . No, the metal frame of a building without supplemental grounding is considered as being effectively grounded if it has a resistance to ground of 25 ohms or less.

Interpretation No. 248

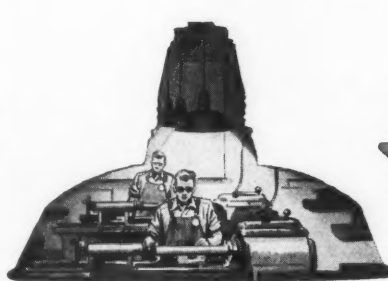
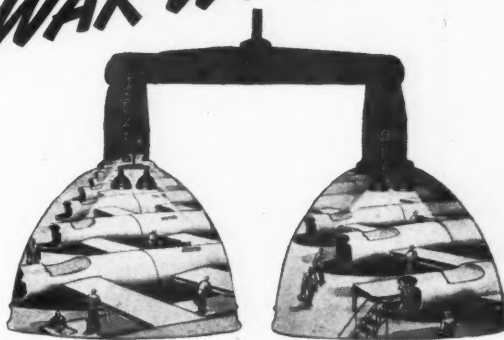
QUESTION . . . What articles or sections of the 1940 National Electrical Code apply to the installation of a stationary motor-driven welding generator and its associated equipment?

ANSWER . . . Electric welding is a special application of motors, generators, transformers, and other items of equipment. The use of metal structures in buildings as a conductor of arc welding current from motor-driven generators is not covered in the 1940 or previous editions of the Code.

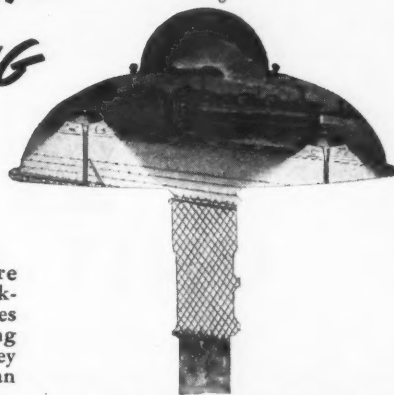


CONTINUING DISCUSSIONS after a three hour session are J. E. Housely, chief electrical engineer for Aluminum Company of America and I. S. Rice, assistant maintenance engineer for Commonwealth Edison Co. at the A.I.E.E. National Technical Meeting, Cleveland, Ohio.

LIGHTING FOR WAR WORK...



REQUIRES PROPER ENGINEERING



Today's industrial tasks are more exacting. And everywhere, war workers are responding to intensive drives for increased production—keeping longer hours, working harder. They require far better illumination than ever before.

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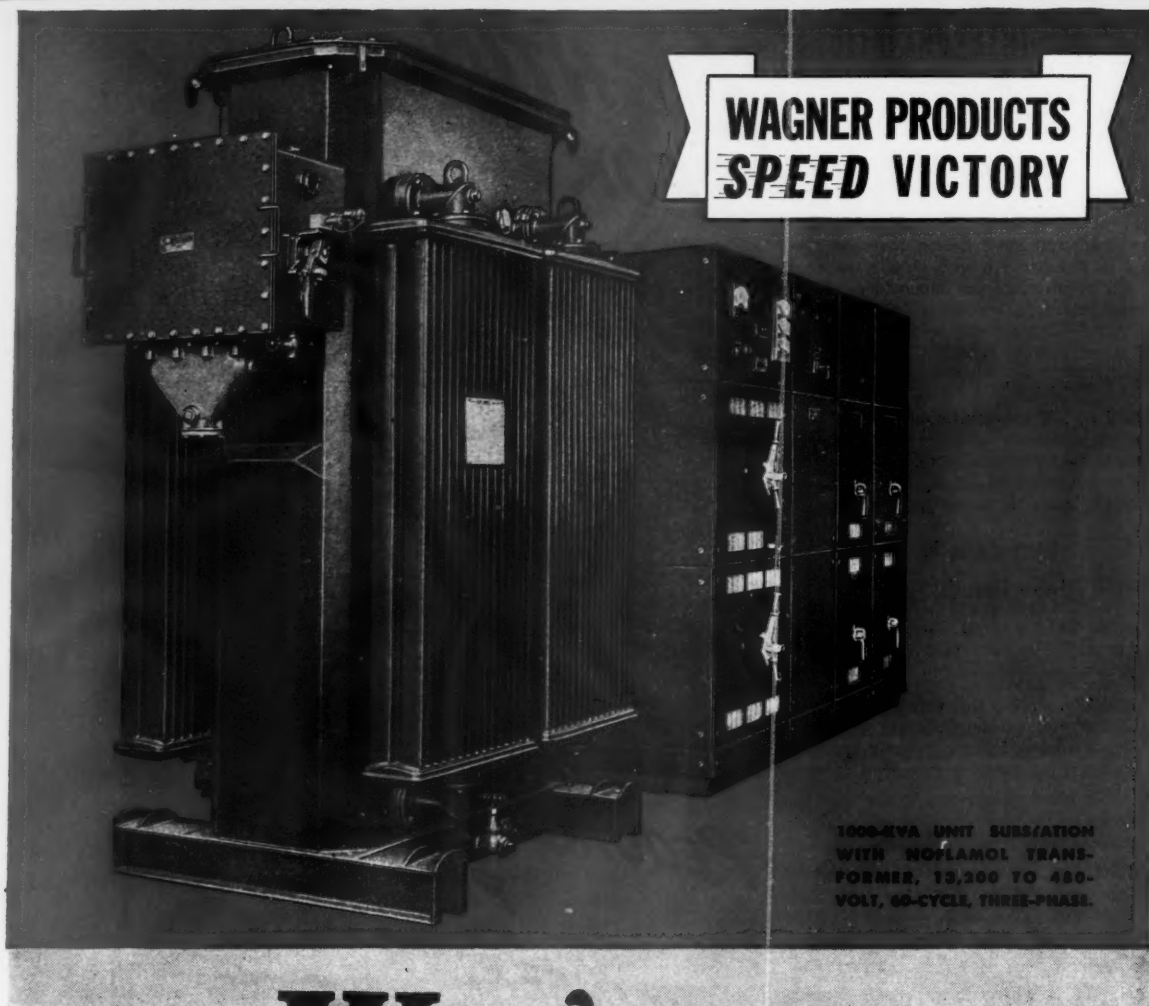
porcelain enamel, the finish that's easy to clean—that lasts a lifetime.

Goodrich illuminating engineers are ready to help you make lighting a more effective aid to war production. Write us.

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The Unit illustrated above is installed in a synthetic rubber plant. The transformer has a two-position liquid-filled disconnecting switch on the high-voltage side which is equipped with low-voltage interlock. The low-voltage side is equipped with air-break circuit-breakers electrically or manually operated, ground indication lights, voltmeters, ammeters, and ammeter test blocks. Unit has one main breaker, one tie transfer breaker, and four feeder breakers.

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ELECTRICAL AND AUTOMOTIVE PRODUCTS

T43-S

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed descriptions, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of **ELECTRICAL CONTRACTING** you saw the item and they will send full details to you.

EQUIPMENT NEWS

Mercury and Incandescent Reflector

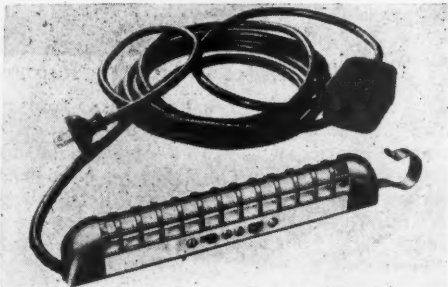


REVERE COMBINATION REFLECTOR

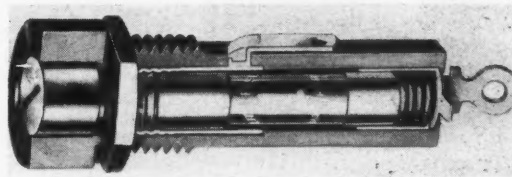
In this dome reflector an incandescent lamp is used in combination with a mercury lamp. This unit was designed to fulfill the need for illumination approaching daylight on both flat and vertical surfaces. Hood and reflector are of heavy gauge steel porcelain enameled white inside and green outside. Lamp wattage is 250 watt mercury and 300 watt incandescent. The reflector is shaped to give wide even distribution of light with a minimum of direct glare and together with the hood, embodies features which dissipate heat accumulated from the lamps. Revere Electric Mfg. Company, 2949 N. Paulina St., Chicago, Ill.

Fluorescent Extension Cord Unit

P-7, the fluorescent extension cord unit, has been streamlined. Changes in design permit fast lamp change; ends have been rounded; rigid hanging hook is riveted to the end cap. It utilizes the small 6-watt fluorescent lamp which provides an adequate amount of cool, glare-free illumination in the hard-to-get-at places. The reflector shields the light source from the user. A protecting grill prevents lamp and socket breakage. The small manual starting switch, rubber-covered cord, remotely mounted ballast and light weight of unit are additional features. Overall dimensions are—length 10½-in., width 1¾-in., height 1¾-in. Operating voltage is 110-125 volts, 60 cycle, a.c. only. Sylvania Electric Products, Inc., Ipswich, Mass.



SYLVANIA FLUORESCENT UNIT



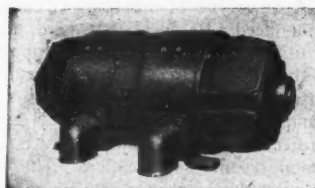
LITTELFUSE EXTRACTOR POST

Extractor Post

This new extractor post is for 3 AG (1¼-in. by ¼-in. dia.) fuses. Anti-vibration side terminals are mechanically connected by electrical welding to metal shell inside the bakelite body and backed up by solder. The terminal is proof against heat and vibration. It is for fuses to 15 amps., and is used for radios, auto-radios, amplifiers, fractional hp. motors, magnets, control circuits, relays, rectifiers, plate circuits. Overall length is 2¼-in. Length from front to panel 2½-in.; mounting hole ½-in.; maximum current 15 amps. It is furnished for screwdriver or finger operation. The fuse grip permits visual shock-proof inspection of fuse. A spring-activated cup at bottom insures positive and continuous electrical contact. A specially designed grip prevents the fuse from dropping out. Littelfuse Incorporated, 4747 Ravenswood Ave., Chicago, 40, Ill.

Motor-Alternator Sets

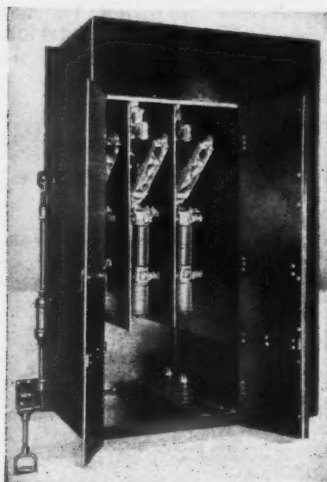
A new line of two-bearing (ball), 3600 r.p.m. motor-alternator sets in integral ratings up to 5 kva., single phase are available. They are designed for converting direct



G-E MOTOR-ALTERNATOR SETS

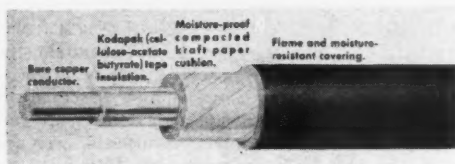
current to alternating current for various applications. In operation, the d.c. motor of the set drives the alternator, which has a field connected in series with the motor armature. An increase in the alternator load causes an increase in the motor load, so that increased d.c. is drawn from the line. This greater d.c. current strengthens the alternator series field, tending to maintain a constant a.c. voltage. The motor and the alternator of these sets are similar in that the armature windings are on the rotating elements and the fields are stationary. A solid shaft, supported by a ball bearing at each end, serves to mount the rotating members of both the motor and the alternator. The complete rotating unit may be pulled out of the stator by removing an end shield. General Electric Co., Schenectady, N. Y.

Load-Interrupter Switch



S & C LOAD-INTERRUPTER SWITCH

A new line of switching and short-circuit protection assemblies containing load switching of high voltage circuits with short-circuit protection has been announced. The load-interrupter switch will interrupt loads up to 400 amperes at 15,000 volts without drawing an arc across the main switch contacts. These assemblies are designed and used for installation at substations, main and branch feeders, and for use as throw-over devices from two alternate feeders or power sources, and for many services where all functions of circuit breakers are not essential. The heavy duty fuses have short circuit interrupting ratings of 20,000 r.m.s. amperes at 13,200 volts; 25,000 at 6600 volts; and 30,000 at 2300/4000 volts. Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, Ill.



OKONITE BUILDING WIRE

Rubberless Building Wire

A new type of building wire called Hazapak has been announced. Its insulations and protective coverings contain no critical materials. The copper conductor is insulated with a synthetic (cellulose-acetate butyrate) tape and further protected with a heavy layer of moisture-proof compacted Kraft paper. The N.E.C. wall of insulation is protected by a flame and moisture resistant fibrous covering made to Dilec specifications. The finished wire is approved by the Underwriters Laboratories. Hazapak type EG (Emergency Grounded) is approved for use as the neutral grounded conductor in a.c. circuits and as the "white" conductor in cable assemblies such as non-metallic and armored cable, twin lead-encased, etc. where WPB rubber restriction order prohibits the use of rubber insulation on the white or grounded neutral conductor. Hazapak Type EI (Emergency Insulated) is approved for single conductor in open wiring as a wartime alternate for rubber insulated wire and as the "hot" wire in non-metallic-sheathed cable that is run exposed in dry locations. Hazapak wire is available in all regular building wire sizes for 600 volt ratings and can be supplied in all standard colors with surface identification markings and footage measurements. The overall diameters are the same as for Type R wire. The Okonite Company, Passaic, N. J.

Fluorescent Luminaire



COMMERCIAL FLUORESCENT LUMINAIRE

A new metal-saving fluorescent lamp developed in accordance with WPB regulations. Non-metallic reflector has a baked on white Glazename reflecting surface and baked on grey enamel exterior. The ballast is mounted on the outside of the pressed steel wireway for cooler operation. Reflector can be easily removed without disturbing wiring. Four models are available—for two 40-watt, for three 40-watt, for two 100-watt and for four 100-watt lamps using special four-lamp ballast. Commercial Metal Products Co., 2251 W. St. Paul Ave., Chicago, Ill.

Fluorescent Lamp Starter

The first starter to carry the three-year rating is called the "Watch Dog." It is a manual-reset type for 40-watt lamps.

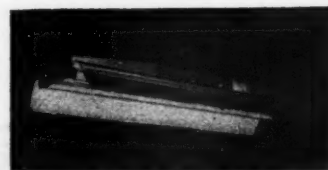
The mechanical features are (1) Precision lamp starting. The "Watch Dog" is timed to light the lamp at the right instant. (2) Dead lamp lockout. Close tolerances in the starter's mechanism make possible a quick and positive performance in the lockout of dead lamps, eliminating blinking and flickering when a lamp burns out. When a dead lamp is removed, the "Watch Dog" is reset by pressing a button on top of the starter. The new lamp is then inserted and the "Watch Dog" brings it into the circuit immediately. General Electric Company, Bridgeport, Conn.



G-E FLUORESCENT LAMP STARTER

Fluorescent Unit

A new industrial fluorescent lighting unit known as Super-Illuminator has been announced. It is available in sizes for two and three 40 watt and two 100 watt fluorescent lamps. All wiring and auxiliaries are enclosed. Positive "flexible trigger" supports allow quick, easy reflector removal. Starter switches are accessible without removing lamps and bump-proof end-plates give added lampholder protection. They are listed by Underwriters Laboratories. Reflector is Guth-formed Masonite "Reflector-Board" and is finished 300° white high-baked synthetic enamel. Eggcrate louvers are available for lamp shielding. The Edwin F. Guth Company, 2615 Washington Ave., St. Louis, Mo.



GUTH FLUORESCENT FIXTURE



Sky Trap for Zeros

SET AND SPRUNG... IN SECONDS... BY MATCHED MOTOR AND CONTROL

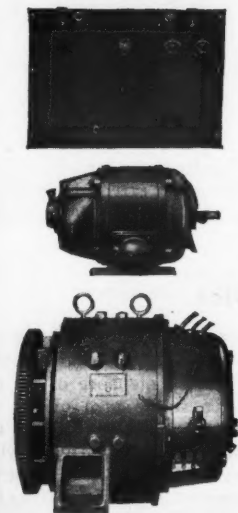
The siren wails ... the searchlights and locators of this "Zero Trap" swing into position as a unit. Wherever the locator points, there also points the searchlight — instantly and automatically. Enemy aircraft are detected and spotted in seconds for anti-aircraft gunners to send to their doom.

This important complete co-ordination is made possible by matched motor and control which duplicate the movements of the locator. Without it, many vital extra seconds would be consumed for the operator to instruct the searchlight operator where to direct the light beam.

The power behind this "sky trap" is an engine-driven generator set — with cooling fan motor and control panel. This unit supplies power for the arcs, movements and control mechanisms of the searchlight system.

This is only one of many Westinghouse war motor applications...applications that build up engineering experiences you can use. Save time, save money, save effort on your next motor and control job. Just call your nearest Westinghouse Office for "jiffy" help. Westinghouse Electric & Mfg. Co., Dept 7-N, East Pittsburgh, Pa.

J-21206



Power plant control panel for co-ordinating searchlight and sound locator. Fan motor (middle) and d-c generator.



Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

MOTORS AND CONTROL

Synchronous Motors

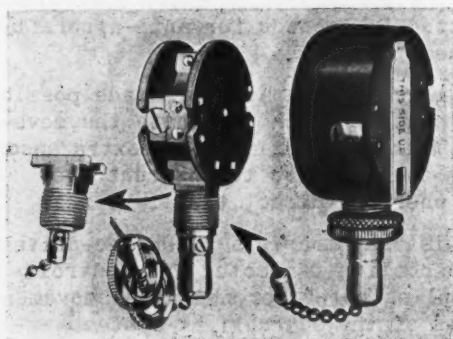


G-E MOTORS

A new line of vertical high-speed, hollow shaft synchronous motors has been announced. Furnished in ratings from 100 to 1000 hp., and in speeds from 514 to 1800 r.p.m., these motors are desirable for pumping applications where a large volume of fluid is handled, such as in ordnance and synthetic rubber plants and on municipal and government water projects. For protection, these motors have a dripproof enclosure. The top cover of the motor is easily removed to permit adjustment of the pump shaft. The motors can be furnished with non-reverse ratchets to prevent reversal of pump rotation at shutdown or on starting. They are also available in solid-shaft construction. General Electric Company, Schenectady, N. Y.

Plastic Shell Switch

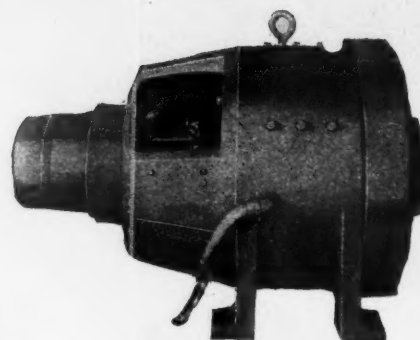
The No. 1010 plastic shell Levolver switch has been added to this line. It was recently redesigned with a plastic casing in place of the former brass shell. An additional saving in critical metal is now effected through the use of a plastic material in the fabrication of a frame to which the top and bottom disks are secured. The front member of this frame is threaded to take the mounting nut. This unit was formerly made of steel. This is a 10 amp. 125 volt, "T" rating switch, equipped with the Levolver control. McGill Manufacturing Co., Inc., Valparaiso, Ind.



McGILL SWITCH

Generator

A new Katolight generator has been added to this line. It has a rated capacity of 25 k.w. at 80 per cent p.f., single phase or 30 k.w. at 80 per cent p.f., three phase. This unit is 38-17/32-in. long by 24 1/2-in. wide by 25 3/4-in. high. Revolving armature type, separately excited, six pole, 1200 r.p.m. with damper windings for synchronizing. Available in all standard voltages and special voltages, either straight 110, 220 or 440 volts single phase or 115/230 or 220/440, four ring, single phase. It is designed for direct attachment to engine bell housing. Also available as an independent

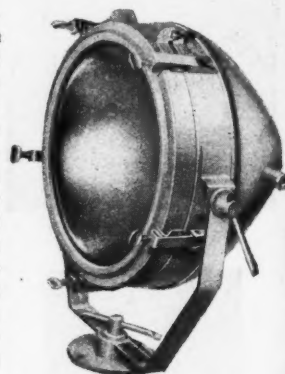


KATOLIGHT GENERATOR

generator with standard shaft extension. The standard exciter voltage is 125 volts. Exciter is of two pole laminated inter pole design. Kato Engineering Co., Mankato, Minn.

Floodlight

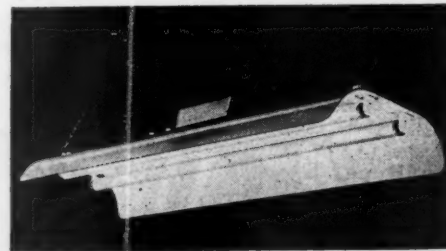
This new 500 watt floodlight, Navy Specification 98-5452, has been designed for rugged service, built to withstand concussion, vibration and exposure to sea atmosphere. The housing is of heavy gauge spun steel. The lens door frame is hinged on widely spaced supports and is fitted with winged screw latches to provide perfect alignment and accurate compression on the gasket. High coefficient of reflection is obtained by silvered reflector. Floodlight rotates on trunnion allowing 260 deg. horizontal rotation and yoke permits unlimited vertical adjustment. It may be locked in any position. Revere Electric Mfg. Co., 2949 N. Paulina Street, Chicago, Ill.



REVERE FLOODLIGHT

Reflector Release Device

A feature of the new Smithcraft fluorescent lighting unit is the device for quickly releasing and replacing the reflector. It facilitates installation and maintenance of the unit under varying conditions. By a single turn of the two wing nuts the reflector is released. Another turn and it is back again. The wing nuts carry captive hood bolts which slide in and out of a pair of coves which are a part of two cross bridges welded to the housing. A. L. Smith Iron Co., Chelsea, Mass.



SMITH REFLECTOR RELEASE DEVICE

Steel AND OTHER CRITICAL
MATERIALS - - - -

STILL WAR TIME NECESSITIES

Porcelain

PROTECTED WIRING SYSTEMS

RELEASE STEEL AND MAKE
POSSIBLE HIGHLY MODERN WIRING

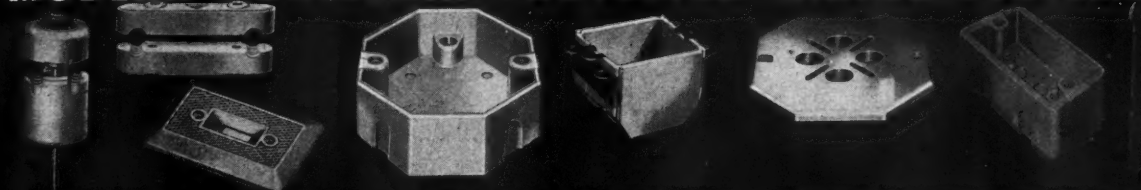
• A shortage of 4,000,000 tons of steel for the fourth quarter of 1943 is anticipated according to WPB Release 4027 of August 10, 1943.

This calls for continued and full cooperation with WPB on the part of Electrical Contractors in following existing directives requiring non-metallic wiring. Porcelain Protected Wiring Systems help greatly in the conservation of steel and other critical materials. Porcelain offers permanence—safety—economy—simplicity of installation, and insurance against maintenance.

You can easily keep in step with government directives relating to the use of non-metallic wiring materials and yet get a full share of wiring jobs with attendant profit. Also you build good will for the future because Porcelain so well meets wiring construction requirements not only for the moment but for years.

• The companies listed below will be glad to cooperate with you in supplying your needs.

MODERN PORCELAIN PROTECTED WIRING SYSTEMS



★ ILLINOIS ELECTRIC PORCELAIN CO.
Macomb, Ill.

★ KNOX PORCELAIN CORPORATION
Knoxville, Tennessee

★ PORCELAIN PRODUCTS, INCORPORATED
Findlay, Ohio

Keep Up-to-date on new developments through this **FREE SERVICE**.....

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation.

INSTRUMENTS

1 Bulletin 1735 illustrates and describes the new Megger insulation testers built in this country. They are the Megger generator and direct-reading ohmmeter type. James G. Biddle Co.

INSULATING MATERIALS

2 A 60-page catalog covering the entire line of G.E. insulating materials. It lists and describes hundreds of items including varnished cloths, varnishes, Glyptals, tapes, cords, cotton sleeving, varnished tubings, mica, wedges, soldering materials, cements and compounds. General Electric Company

ELECTRIC MOTORS

3 A new catalog featuring electric motors, gearshift drives, pedestal grinders, magnetic polishing lathes, special rotors and stators. The Lima Electric Motor Company

THREADING MACHINES

4 A new manual designed especially to help operators of No.

300 Series Oster pipe and bolt threading machines. It contains three sections and covers operators, maintenance and spare parts. The Oster Manufacturing Co.

MAGNETS

5 An 8- by 20-in. card to be hung in the magnet crane cab features operating and maintenance tips for lifting-magnet operators. Cutler-Hammer, Inc.

GEAR-MOTORS

6 A 16-page illustrated bulletin, GEA-1437D, describes the many types of gear-motors, lists their advantages and indicates the various locations where their use is most desirable. General Electric Company

MAINTENANCE HANDBOOK

7 Handbook No. 143 tells how to keep motors and generators operating continuously at peak efficiency without dismantling. It features motor maintenance equipment, industrial electrical equipment, variable speed transmissions, wiring devices and tools. Ideal Commutator Dresser Co.

FLUORESCENT TRANSFORMER

8 A folder illustrating and describing the Insta-Start fluorescent transformer, which provides positive, split-second, non-mechanical starter and ballast in one unit. The France Manufacturing Co.

MOTORS

9 Form SCF-1 describes and illustrates the various enclosures and degrees of protection available for squirrel cage motors, 1-75 hp. Form SCF-2 covers direct current motors, 3/4-7 1/2 hp. Crocker-Wheeler Electric Manufacturing Company

BUSDUCT

10 Supplement to Bulletin No. 65 describes war model busduct distribution systems for light and power. It covers feeder busduct, plug-in busduct and accessories. Frank Adam Electric Co.

ELECTRICAL CONNECTORS

11 A new bulletin containing 28 pages and covering descriptions, applications, illustrations, sketches and tabular data on Type DP rack and panel electrical connectors. Cannon Electric Development Co.

INSTRUMENTS

12 Publication GET-1173, entitled "Electric Instruments, Principles of Operation" presents a discussion of the characteristics of instruments, what makes them operate, and the individual limitations of the various types. General Electric Company

INSULATING VARNISH

13 A new six page folder on Synthite PG-1 clear baking varnish gives information on baking and vacuum impregnation of electrical units with insulating varnish. John C. Dolph Co.

FANS

14 A new pocket-size book entitled "Maintenance and Installation

[Continued on page 104]

Circle numbers, sign and paste on your letterhead and mail in an envelope.

ELECTRICAL CONTRACTING															October														
300 West 42nd St.																													
New York, N. Y.															(Not good after December 1)														
Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.																													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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ADDRESS																													
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**CENTRAL
RIGID STEEL
CONDUIT**

Protection

you'll be proud to sell!

*"There's Tested Strength
in Every Length"*

IT is easy to sell Central Rigid Steel Conduit because it has a good reputation.

It has established records for long, dependable and economical service in many industrial and commercial installations in all parts of the country.

It gives *your* customers the kind of protection you'll be proud to sell.

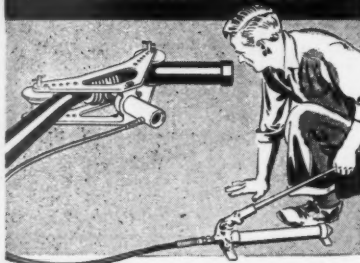
SPANG-CHALFANT

Division of The National Supply Company

Executive Offices: Grant Building, Pittsburgh, Pa.

District Offices and Sales Representatives
in Principal Cities

JUST THE "TICKET" for Speeding Up Wartime Work



Low-Cost **BLACKHAWK** Pipe Bender has **EVERYTHING!**

- COMPACT
- PORTABLE
- ONE-MAN OPERATION
- ON-THE-JOB ACTION
- BENDS PIPE AND RIGID CONDUIT FROM 1" TO 4"

You bet! — and Blackhawk Hydraulic Pipe Benders operate at any angle — avoid kinking, save need for heating or cutting and threading and use of elbows and couplings. Compact 10 or 20-ton ram and big range of attachments also handle many other bend, straighten, press, push, pull, spread and clamp jobs.

Right — Easy to operate even on ladder. Below — Rolls right to the job.



MAIL COUPON TODAY

BLACKHAWK MFG. COMPANY
Dept. P20103, Milwaukee, Wis.

Send full information about
your Pipe Benders.

Name.....

Company.....

Address.....

Data" covers industrial fans and air conditioning equipment. Buffalo Forge Company

SWITCHES

15 New illustrated, loose-leaf, file size catalog showing complete line of Acro Snap-Action Midget switches for various applications. Gives engineering data on construction. Acro Electric Company

MOTORS AND GENERATORS

16 Form SCF-102 shows photographs and application information on marine installations of pumps and motors. Form SCF-101 covers descriptions of turbine driven shipboard auxiliary generators. Crocker-Wheeler Electric Manufacturing Co.

CONTROL CENTERS

17 A new circular describing and illustrating the Trumbull line of control centers, including motor control centers and switchboard control centers. The Trumbull Electric Mfg. Co.

SOCKET WRENCHES

18 A 12-page booklet entitled "Meet the Mechlin" presents helpful suggestions for buyers and users of socket wrenches. Blackhawk Mfg. Co.

AUTOMATIC TIMING EQUIPMENT

19 Catalog No. 1 on timers, relays and switches describes the function of the different types of timers and also mentions for just what applications the particular timers are generally used. The R. W. Cramer Company, Inc.

FLUORESCENT FIXTURE

20 Bulletin F-69 illustrates and describes the new Day-Line industrial fluorescent unit for single or continuous installations. DayBrite Lighting, Inc.

RADIANT HEAT LAMPS

21 A 12-page booklet A-3817 features radiant heat drying lamps for drying, baking and heating processes. It discusses the design of radiant heat installations, the arrangement and spacing of equipment and electrical circuit design. Westinghouse Electric & Manufacturing Co.

ARC-WELDING ACCESSORIES

22 A new 36-page bulletin, GEA-27 4C, illustrating and describing the complete line of arc-welding accessories for men and women operators. General Electric Company

WIRE

23 Bulletin No. 210 describes Hazapak rubberless wire, a new type of building wire. It is produced in two types—EG, emergency grounded, and EI, emergency insulation. Hazard Insulated Wire Works, Division of the Okonite Company

FLUORESCENT LAMP CARRIER

24 A new folder illustrating and describing Fluore-Lamp carrier for servicing fluorescent lighting installations. Available in four standard models, 6-ft., 8-ft., 10-ft. and 12-ft. high. Ultramar Manufacturing

FITTINGS

25 Bulletin No. 44 illustrating the Gedney line of fittings for electrical wiring applications. Heron Electric Sales Corp.

MARINE SIGNAL DEVICES

26 A new Bulletin No. 480 illustrates and describes a complete new line of marine signaling devices and systems. One section is devoted to technical data on the brazing of terminal tubes for steel boxes. Edwards and Company

ANCHORING DEVICES

27 A new 20-page catalog presents helpful data for users of all types of expansion anchoring devices. Items covered are expansion bolts, expansion nuts, anchoring units, toggle bolts, etc. Chicago Expansion Bolt Company

SAFETY BOOKLET

28 A new 12-page booklet, GEQ-217, entitled "Safety Regulations for Women in Industry". It is directed to women working on machines and on mens' jobs. General Electric Company

POWER VISE STAND

29 A new manual designed to help operators of No. 422 power vise stand, a portable power drive for hand pipe tools. The Oster Manufacturing Company

LAMP BALLAST

30 A folder illustrating and describing the new Magno-Tronic plug-in fluorescent lamp ballast with "Perma-Gap" construction. Commercial Engineering Division, Industrial Electronics Corporation

PIPE THREADING MACHINES

31 Two manuals designed to help operators of No. 502 "Pipe Master" and No. 562 "Tom Thumb", portable pipe threading machines. The Oster Manufacturing Co.

MOTORS

32 Bulletin 344A illustrates and describes squirrel cage induction polyphase motors. It tells how to select the motor best suited for the application. Century Electric Company

RATING WELDING MACHINES

33 A bulletin explaining the new "WSR" method of rating welding machines, shows the exact range of usable welding current. Harnischfeger Corporation

Electrical Contracting, October 1943

SOLVENT CHART

34 A new solvent chart for reducing benzine solvent varnishes. It may be used for reducing varnishes from 35° Beaume (0.849 specific gravity) to as low as 20° Beaume (0.933 specific gravity). John C. Dolph Company

ENCLOSED SWITCHES

35 Bulletin No. 70 covers descriptive data on the Shutlbrak line of heavy duty industrial switches—Type A interlocking and Type B non-interlocking. Frank Adam Electric Co.

FITTINGS AND CONNECTORS

36 A new catalog covering the complete line of conduit fittings, cable terminators and grounding devices. Included are new fittings, engineering data, list prices and dimensions. O. Z. Electrical Manufacturing Co.

RECTIFIERS

37 Illustrated catalog sheets Nos. 300 and 301 describe many new models of industrial electrical rectifiers. Advantages are explained and price list is included. McColpin-Christie Corporation, Ltd.

ELECTRONIC LEVEL CONTROLS

38 A four page folder illustrating and describing electronic level controls for all conductive, non-conductive, corrosive, combustible, liquids and powders. Photoswitch Incorporated

SPOT WELDING MACHINES

39 A 28-page bulletin No. 93-W-43 describing this line of small spot welding machines. Operating principles, typical standardized arrangements and special applications are explained. Eisler Engineering Co.

ELECTRICAL EQUIPMENT

40 Catalog No. 24 consisting of 46 pages of illustrations and descriptions on this line of electrical and allied equipment, including commutator stones, undercutters, ammeters, fuse pullers and testers. The Martindale Electric Co.

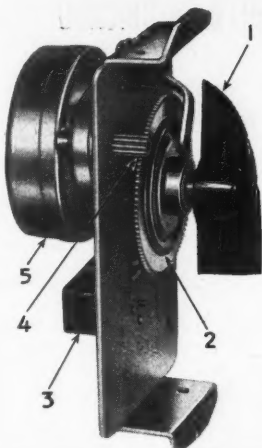
PIPE GAGE

41 A four-page folder illustrating and describing a new pocket size, pipe gage for instantaneous measurement of all sizes of pipe from 1/8-in. to 12-in. Three-Point Gage Company

MOTOR BUYING DATA

New simplified buying data in bound and loose-leaf form for quicker selection; easier ordering and quicker delivery. It contains 180 pages and covers popular types and ratings of motors, generators and M-9 sets. Buyers of motors and control may secure copies from the district offices only of Westinghouse Electric and Manufacturing Company.

Another Paragon Timer achievement!



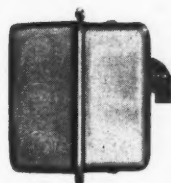
2400 Series
For flush mounting



2900 Series
Wall mounting



2500 Series
Enclosed type



2500 Series
Side view
Mounts on handy boxes

Here's a notable development in automatic electric timers . . . which includes several distinct engineering and operating improvements.

ENGINEERING FEATURES

1 The setting knob is directly connected thru the switch operating cam; unit does *not* set thru a clutch; this provides positive switch action.

2 All energy required to operate switch itself is built up by manually setting pointer. Motor and clutch thereby relieved of all drag.

3 Switch—single pole, double throw, 1000 watt capacity, fully enclosed. Underwriter's approved.

4 Only 2 exposed gears—motor pinion and wheel. Precision hobbled.

5 Motor—self starting, slow speed, industrial type synchronous, completely sealed.

6 No energy is required of clock motor to trip switch at end of present time.

7 Nine time ranges from 0 to 14 1/4 seconds through 0 to 9 1/4 hours. Available in all types of enclosures.

8 All parts rust proofed and protected against corrosion.

NUMEROUS APPLICATIONS

Adaptable to any manually preset application with automatic switch operation at end of time cycle, such as plastic molding, rubber curing, batch mixing, heat treating, enamel baking, liquid agitation, light exposure—photographic, therapeutic, blue printing, infra-red drying,—blower operation, pump operation, conveyor operation and food processing.

PRECISION BUILT: This and every other Paragon unit is precision built, simple, accurate, reliable, modern and reasonably priced. Made by an organization of designers and engineers, growing since 1905.

SEND FOR BULLETIN . . . containing complete construction and installation data.

PARAGON ELECTRIC COMPANY

401 S. DEARBORN ST. • CHICAGO 5, ILL.

Paragon Chicago

BUILDERS OF ELECTRICAL EQUIPMENT

SINCE 1905

IN THE NEWS

NECA WAR CONFERENCE TO BE HELD IN CHICAGO

Industry leaders to discuss war and postwar problems at a two day convention session.

The 42nd annual meeting of the National Electrical Contractors Association will be held at the Drake Hotel in Chicago, on Sunday and Monday, October 10-11.

In view of wartime conditions, the program will be devoted entirely to the business problems facing the industry today and in the postwar period. It is planned to provide an opportunity at each of the four business sessions for open discussions of these problems and the formulating of policies for the future. Informal group luncheons and dinner sessions are being arranged.

Meetings begin on Sunday morning, October 10th and will continue throughout the day and on Monday with the conference adjourning at 5 o'clock October 11.

The program is as follows:

Sunday, October 10

Morning Session, 10:00 A.M.

General Manager's Report

"Public Relations"—R. W. McChesney, President, NECA, Washington

"Meeting Essential Civilian Requirements"

Legal Clinic: "Renegotiation, Taxes and Contract Procedure" Conducted by Col. O. R. McGuire, General Counsel, NECA, Washington

Luncheon—1:00 P.M.

Round-the-Table Talks

Afternoon Session, 2:00 P.M.

Report on Postwar Plans and Recommendations—M. H. Hedges, Co-chairman, Labor-Management Planning Committee for the Electrical Construction Industry, Washington

"Making Plans Effective"—E. J. Brown, President, IBEW, Washington

"Conserving Manpower in Plant Maintenance"—Joseph D. Keenan, Vice-chairman, War Production Board, Washington

Clinic: "Maintenance Contracts and Job Costs" Conducted by J. Walter Collins, Secretary, Chicago Chapter, NECA

Annual Dinner—7:00 P.M.

Monday, October 11

Morning Session, 9:30 A.M.

"Importance of Chapter Organization"

—D. B. Clayton, President Electric Constructors, Inc., Birmingham, Ala., and Pascagoula, Miss.

"Electrical Contractors' Services in Distribution"—A. Herrmann Wilson, President, Electrical Construction Co., Inc., Washington

"Putting Some Meat Between the Bread of Contracting"—Clyde L. Chamblin, President, California Electric Construction Co., San Francisco

Luncheon—1:00 P.M.

Round-the-Table Talks

Afternoon Session, 2:00 P.M.

"Postwar Standards"—George Andrae, President, Herman Andrae Electrical Co., Milwaukee

"Sound Estimating the Backbone of Contracting"—H. B. Tinling, General Manager, Tinling & Powell, Spokane, Wash.

Revision of NECA Constitution
Election of Officers
Report of Resolutions Committee
Adjournment

SECONDARY DISTRIBUTION EQUIPMENT CUT

Steel, copper, brass, aluminum, etc. used in the manufacture of secondary electrical distribution equipment has been limited by General Limitation Order L-315 to conserve critical materials.

The devices covered by the order are those rated at not more than 600 volts; enclosed safety switches rated from 30 to 2400 amperes; enclosed branch and service circuit breakers rated at not more than 600 amperes; knife switches rated 30 to 1200 amperes; all service entrance equipment; and all panel and distribution boards.

The more important restrictions are:

1. Maximum gauge of steel enclosing cases are specified.

2. Doors for dead-front type panelboards are prohibited.

3. The use of non-ferrous metal is prohibited in neutral terminal plates in devices rated 70 amperes or less, and in many other minor parts.

4. The use of galvanized steel for enclosures is prohibited and aluminum, copper, chromium, nickel, zinc or alloys or finishes made of these metals are not allowed to be used for enclosures, nameplates, identification plates, door hinges and handles, and operating handles. However, operating handles may be zinc plated.

5. Switches, breakers and equipment of type listed above may not be specifically designed for internal mounting of current transformers, meter test blocks, meters or contactors.

These and other provisions in full detail restricting use of metals are specified in Schedule A of the order. Equipment for direct use of the Army, Navy, Maritime Commission and War Shipping Administration (shipboard use only), and for direct use on aircraft is exempted.

To further conserve materials by eliminating distribution for non-essential uses, purchase orders are limited to those with AA-5 or higher ratings.

The Underwriters Laboratories, Inc., has cooperated with WPB by issuing wartime emergency standards consistent with the provisions of this and other orders pertaining to the conservation program.

COPPER WIRE AVAILABLE

Retailers, electricians, radio repair men and others who sell copper wire to the general public may purchase limited quantities and sell it to the public without restriction, under CMP Regulation No. 9.

Any retailer or repair man may order up to \$100 worth of copper wire for delivery during any calendar quarter. If he needs more, he may determine as accurately as practicable the dollar value of the copper wire he sold as a retailer or used as a repair man during 1941 and he may buy in any calendar quarter one-eighth this amount.

Three million pounds of copper per calendar quarter have been earmarked for this program. Civilians must use this with care, WPB officials pointed out, as it will be needed to cover all essential repairs for general public use.

In selling copper wire under the new regulation, retailers need not pay attention to any preference rating other than AAA or a farmer's certificate under Priorities Regulation No. 19.

Retailers and repairmen may purchase copper wire under the Regulation, up to their individual quotas, by placing on their orders the following certification:



Ⓣ Busduct System Installed
in a small laundry.

Economical... for Small Plants as well as Large

Some plants have been equipped with miles of

Ⓣ BUSDUCT

Many small ones have required a hundred feet, or even less. And, of course, there are many "in-between." In every case, however, the installation of this convenient and flexible method of Ⓣ Busduct distribution for electric light, heat and power has been accomplished at surprisingly low cost.

Both Feeder and Plug-in Ⓣ Busduct may be taken down and moved to new locations without appreciable loss of material. Standard sections, with pull boxes, elbows, end closures, tees and crosses, make it possible to fit any desired arrangement, so that changes in location of machines is rendered easy.

Designed for 2, 3 and 4 wire systems,
575 volts AC, maximum.

Ⓣ Busducts are now made under W.P.B.
Limitation order L-273. They have the
same basic features of construction as
the standard model.

The Ⓣ Sales-Engineer Can Help You

in planning and designing an efficient
and convenient Ⓣ Busduct Distribution
System. No obligation, of course. Bulletin
65 (and supplement) give full details.
They will be sent promptly on request.
... Frank Adam Electric Company,
P.O. Box 357, St. Louis, Missouri.



"CMP allotment symbol V-3—The undersigned certifies subject to the criminal penalties of section 35(A) of the U. S. Criminal Code, that he is a retailer or repairman entitled under CMP Regulation No. 9 to buy the copper wire covered by this order."

Retailers and repairmen may buy copper wire from other retailers or repairmen without certifications or other formalities. They may not use the procedure established under the new regulation to obtain copper wire in excess of inventory limits established.

ELECTRICAL LEAGUES VIEW FUTURE

Electrical League leaders throughout the country converged on Cincinnati last month with brief cases bulging with evidence of the vital job they are doing for the wartime electrical industry. Some carried plans for the immediate future; others packed their favorite crystal balls for a glimpse into the postwar era.

The occasion was the Eighth Annual Conference of the International Association of Electrical Leagues. The purpose—to provide an opportunity to study the nation-wide activities of the Leagues with a view to more and better cooperation with the war effort now and in the immediate future; and to discuss possible postwar obligations and opportunities.

The two-day session, planned on an open forum basis, brought forth many gratifying reports of League promotional campaigns for conserving and utilizing electrical appliances and equipment; for educational and training programs to supply the electrical industry with competent appliance repairmen, refrigeration and air conditioning service mechanics, radio service men; and study courses for plant maintenance engineers and electricians.

The basic philosophy of present day League operation was expressed by retiring president John A. Morrison, Philadelphia, when he listed the group's obligations as (1) to do everything possible to aid the war effort, (2) to keep the electrical industry in the public eye, and (3) to align thinking to keep pace with changing times. To this end the Leagues have shelved, for the duration, their merchandising programs and intensified their educational, service and training activities.

During the opening session, J. Clark Chamberlain, San Diego and W. D. Shaler, Pittsburgh, led the discussion on appliance repair, servicing and swapping activities. A. H. Kessler, Minneapolis, reviewed home economic and wartime nutrition programs. The value of industry meetings, public relations and educational programs for maintenance engineers and electricians were outlined by C. H. Christine, St. Louis and Sheridan Taylor, Philadelphia.

A. E. Schanuel, New York, reported that 120 electrical centers throughout the country serving some 14,500,000 customers had some form of Adequate Wiring war program in effect last year. To make the public more conscious of electrical adequacy after the war, he recommended the inclusion of wiring instruction in every school in the nation. Washington,

D. C., is already telling the story of electrical home maintenance for wartime service in the home economic classes of its junior and senior high schools.

Postwar planning with all its "ifs" was the subject of an all-day session. Discussions on the residential market were led by Arthur Hirose, *McCalls Magazine*, and L. E. Moffatt, editor, *Electrical Merchandising*. Controlling factors were listed as—the time the war ends, the type of economy under which we will be living after the war, and the amount of money left over for purchasing. A postwar home building boom is considered one hope for the merchandising industry. Reconversion in the appliance field will take from one to six months with refrigerators taking a little longer, was the prediction.

The postwar picture in the commercial and industrial market were the subjects of R. T. King, Trenton, N. J.; F. A. Kolb, Pittsburgh; and S. E. Strunk, Cleveland, Ohio. Results of surveys presented indicated a large market for fluorescent lighting in commercial establishments and a definite need for new equipment in some industrial establishments after peacetime reconversion. Predictions were that some war plants would be pigeon-holed, others dismantled and sent abroad to replace blitzed plants in Europe; some would go into new and expanded peacetime production—such as electronics, aviation, infrared drying and so on. Another prediction was that much of our used equipment might be sent abroad after the war. Mass production of appliances of medium price range and new and special motor applications were others.

W. A. Ritt, Minneapolis, was elected president of the Association at the regular business session, taking over the duties of John A. Morrison of Philadelphia. E. P. Zachman, Cincinnati, was chosen vice-president and Ralph Neumuller, New York, treasurer. O. C. Small, New York, was re-elected secretary of the group.

RATINGS UNDER CMP NO. 5 ADJUSTED

The War Production Board has announced that preference ratings assigned for maintenance, repair and operating supplies, under CMP Regulation No. 5, have been adjusted.

Schedules I and II of the Regulation, which indicate the ratings assigned to producers of particular products and to particular industries, have been modified to reflect the existence of specific MRO preference rating orders which are applicable to specific industries.

Changes in ratings are indicated in Schedules I and II of the Regulation, as amended September 13, 1943.

EVERTZ RETIRES

When Fred O. Evertz, superintendent of the electrical department, Ohio Inspection Bureau and West Virginia Inspection Bureau, of Columbus, Ohio, retired on September 15, he rounded out 37 years of service with the Bureau.

Mr. Evertz' varied and interesting career in the electrical field began at the age of 15 when he was employed with the Emerson Electrical and Manufacturing Company. Then he switched to the contracting field as wireman and foreman for various electrical construction companies. Following this he was maintenance superintendent for the Imperial Light and Power Company of St. Louis. His really big job followed when he was called on to design and execute the electrical displays at the great Louisiana Purchase Exposition in St. Louis.

Following the Exposition, he became city electrical inspector of Paducah, Kentucky. In 1906, he entered the employ of the Ohio Inspection Bureau and



"The next guy that asks me who I'm carrying the torch for is going to get this right over his head!"

MILLER 50 and 100 Foot Candles ARE BACK!

... a real continuous fluorescent lighting system now available to war industry!

WAR INDUSTRY INSISTED they needed the vital benefits of MILLER 50 FOOT CANDLER and 100 FOOT CANDLER for better, faster, safer production. WPB agreed, but in the same breath asked us to help conserve war-precious metal. The problem—how could we serve them both?

MILLER ENGINEERING LICKED THE EMERGENCY

Yes, the same men who pioneered continuous-row fluorescent went back to their boards . . . surveyed the situation . . . and actually designed an *improved* 50 and 100 FOOT CANDLER.

They eliminated the use of considerable metal—yet produced a sturdy, substantial lighting fixture. They went over to building's proven material, Masonite—for lightweight but extremely durable re-

flectors. They redesigned the reflectors—yet did not sacrifice lighting efficiency. They simplified construction features—so starters could be conveniently located between lamps—so ballasts could be exposed for cooler operation.

AND — in addition to providing it in single unit 4-foot and 5-foot lengths—it is available in double lengths, 8-foot and 10-foot. It is the strength and rigidity of these double lengths that again make possible real continuous-row fluorescent lighting with its savings in installation cost.

These are the highlights. There's a lot more to the story—important to you right now. Better write for full information.

QUICK FACTS FOR FAST READERS

IMPROVED DESIGN of the MILLER continuous fluorescent lighting system, introduced in 1939.

RUGGED LIGHTWEIGHT EQUIPMENT — with sturdy, Masonite reflectors—and no reduction in lighting efficiency.

EXPOSED BALLASTS — for cooler operation — with starters conveniently located between lamps.

HIGHER ILLUMINATION — 30, 40, 50 or more foot candles. Units available in 4-foot and 8-foot lengths for 40-watt lamps — in 5-foot and 10-foot lengths for 100-watt lamps.

INSTALLATION SAVINGS from 30% to 50% possible through the use of rigid double length units in a continuous-row lighting system.

SIMPLIFIED MAINTENANCE — reflectors are so easy to handle and remove that women workers can take care of them.

SAFETY "PLUS" — the MILLER patented Safety Lamp Lock is available as an integral part of each socket, minimizing the danger of falling lamps.

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Material





Have you ever been out of a job?

What you can do

The best way to insure good jobs and better living is to create an environment favorable to continuous industrial progress.

The best way to insure healthy industrial progress is through a nation-wide understanding of the fact that we live better through doing more work in less time.

Nation-wide understanding of that fact will result in laws that encourage industrial progress.

Nation-wide understanding always will be a will-o-the-wisp, unless each business man does his share of: (1) Understanding his own responsibilities in maintaining industrial progress; (2) Explaining the relation between good business and good living to his employees and neighbors.

The newspaper advertisement reprinted here is McGraw-Hill's share in the job of explaining the source of good living. It has appeared in Washington, New York and Chicago, as well as in all McGraw-Hill publications. It is available, for use over your own company signature, in your plant city. A mat, six-column size for newspaper reproduction, will be sent to you upon request. Booklet reprints are also supplied at cost (\$10.00 per thousand).

James H. McGraw, Jr.
President

McGraw-Hill Publishing Company, Inc.

IF you have ever been out of a job, and if you had a wife, children and slender resources at the time, then the fattest paycheck will never quite obscure the memory of the days and nights you lived with fear.

Some of that fear lingers in every man's mind, for all have suffered in some degree.

► That's why you hear the words "postwar planning" so often. Americans are determined that, one way or another, they are going to keep our thousands of factories going after the war, so that there will never again be a vast army of unemployed.

As usual, in a democracy, there are two entirely different ideas as to how to make 56 million jobs grow after the war, where only 46 million existed before.

Both kinds of people, who hold these different ideas, sincerely want to make the postwar world a better place for you to live in. They have complicated arguments, backed by lots of figures.

But when you trim all the arguments and figures down, you find that one side believes in DIVIDING jobs to make them go round, and the other side believes in MULTIPLYING jobs so there will be greater opportunity for all.

We believe in the MULTIPLYING plan for making postwar jobs and ask you to believe in it too.

Look back over our history. What made us great? Was it rich soil? Africa's is as rich. Was it

[FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.]

Have you ever been out of a job? (cont'd)

natural resources? China has them in abundance.

NO, the greatness and the good living of America is the direct product of her genius for doing more work in less time.

Invention is the source of improvement, and *improvement* is the multiplier of jobs . . . when products are improved in service or style, or lowered in price, new customers are attracted and new jobs created.

That's why it is true that good living has its source in industrial progress.

When industrial progress is interrupted, we have a depression, and there is less good living.

When (through courageous investment in new and better products) industrial progress is resumed, we go on to even higher levels of good living.

► If every able-bodied person in America is to have a job, then we must all understand the things that make good living possible, and we must all help *improve* the methods that have given so much good living to so many people already.

For businessmen, that means a constant search for improved methods and machines, a regular year-after-year investment in industrial progress. This means avoidance of such things as speculation in inventories that tend to create booms and depressions rather than consistent progress.

For every citizen, it means a constant search for the best ways and means to prevent and cure depressions.

Businessmen, alone, cannot prevent bad times. It's a job for *every* citizen. Every American can help just by knowing that good living comes from doing more work in less time. If you, and all other Americans, swing on to that fact, the laws that control our rate of industrial progress will be better designed to keep the improvement engine running.

That's where government really can be helpful in postwar planning.

It can encourage the "take a chance" spirit that is the basis of all progress. And it can improve the measures which prevent and cure depression.

At present, our laws are not framed to encourage investment in new and better methods.

Many local, state and national taxes work out in favor of keeping an old machine, instead of buying a new one.

► There are tens of thousands of machines in the country that are over 20 years old. Even our shiny new war equipment is living 3 years in one, and will be old when the war is over.

Every machine should be regarded as obsolete as soon as it is installed and work started on a better one. In the long run, that is the best way to multiply jobs and create better living. Our laws should *encourage* the process, not *discourage* it.

New machines can only be bought with the profits created by old machines. The money that is laid aside by industry to develop and buy new machines is called "Seed Money." If laws take away too much of the Seed Money of business, that will prove disastrous. High taxes must be paid, but they should not destroy Seed Money, which is the only source of improvement.

That's why it's so important for everyone, no matter what his walk in life, to know this fundamental fact:

*"Industrial Progress
is the Source of all Good Living."*

THE MCGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

24 publications, which gather "war-news" from the "war-production-front" through a staff of more than 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

MCGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, \$1.00 per 100; \$10.00 per 1000.)

MCGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK (18), N. Y.

THE MCGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

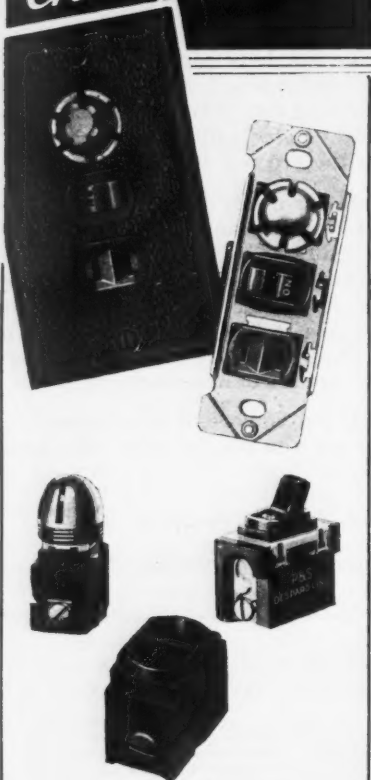
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P&S

DESPARD

Inter-changeability



The interchangeable features of the P&S-Despard Line mean more than ever in these days of limited stocks.

Just the thing for that next job — T-rated switches, double-grip outlets, pilots and accessories.

Keep your P&S catalog handy — Send for a new one if yours is out of date.

SOLD THROUGH
ELECTRICAL WHOLESALERS

PASS & SEYMOUR, Inc.
SYRACUSE, N.Y.

has been with them since. One of his most authoritative subjects was the engineering phase of fire insurance, and his work on fire door requirements has found nation-wide use.

Mr. Evertz is chairman of the Ohio Chapter, IAEE and is an alternate on the Electrical Committee, NFPA, representing the Stock Fire Insurance Companies.

TEMPORARY UTILITY FACILITIES PERMITTED

Supplementary Utilities Order U-1-g issued by the War Production Board permits the construction of temporary utility facilities. Such extensions must be dismantled within 90 days and the materials returned to inventory. The cost of material for such utility extensions must be less than \$1,500 in the case of underground construction, or \$500 in the case of other construction.

PR-13 AMENDMENT EASES IDLE MATERIAL SALES

If industrial material that the seller wants to sell is one of the materials listed on List A of PR-13, which includes items such as pipe and wire, or is made out of one or more of those materials the following are the only kinds of sales that can be made, and if the sale is permitted under any one of the following sub-paragraphs, it may be made:

A holder may sell freely to one of the following Government corporations, or to anyone buying as agent for one of them: Commodity Credit Corporation, Defense Supplies Corporation, Metals Reserve Company, or Rubber Reserve Company.

A holder may sell if he has been given permission by the War Production Board to make the particular sale. This kind of permission can usually be given

only by the War Production Board in Washington. Requests should be addressed to the Redistribution Division of the War Production Board and form WPB-1161 should be used in making the request.

A holder may sell freely to anyone if he has a total of less than \$100 worth of the particular material sold. In deciding whether the holder has \$100 worth he must count all material of the same type and composition. For example, all bare copper wire. This paragraph does not mean that a person may sell freely lots worth less than \$100 if he has more than that amount. It only allows the sale if all he has of that kind of material is worth less than \$100.

If the material is copper, copper base alloy, aluminum or steel in a form described as a "controlled material" in CMP Regulation 1, the holder may sell it to fill an authorized controlled material order or to a buyer who gives him an order bearing a CMP allotment symbol and number and this certification:

The undersigned certifies that he is entitled under CMP regulations to place an authorized controlled material order for the above material.

POSTWAR PLANS STUDIED

With one eye on present conditions and the other on post-war problems, the Board of Directors of the Minnesota Electrical Council, Inc., at a recent meeting at Duluth, Minn., appointed a group of committees to deal with important matters relating to present and postwar plans of the organization.

The following are the Committee designations and their duties:

Sales and Distribution of Equipment and Supplies—Ed Karst, Fergus Falls; E. G. Nylund, Duluth; F. M. Tripp, Minneapolis. This group will deal with strengthening the contractors' position in the sale and distribution of electrical equipment and wiring supplies, and will

[Continued on Page 131]



ELECTRICAL ENGINEERS of the Corning Glass Company who attended the A.I.E.E. National Technical Meeting at Cleveland are left to right: E. M. Guyer, J. J. Torok and W. T. Gray.

Grow with FLEUR-O-LIER!

THE significance of the Fleur-O-Lier idea expressed in the following pages is highly important today—promises to be even more vital in the post-war period. For the Fleur-O-Lier idea with its *fifty definite standards of satisfaction*, and its approved mechanism for *testing, certifying and guaranteeing* lighting fixtures bearing the Fleur-O-Lier label furnishes the public a quick and certain means of identifying *satisfactory* fluorescent fixtures.

The Fleur-O-Lier idea expresses a sound American plan of cooperation for the benefit of the ultimate user

of Fluorescent lighting. Thirty-six manufacturers of lighting equipment participate . . . the fixtures they make are easily identified by means of the Fleur-O-Lier label. Yet Fleur-O-Lier is not a brand name, for these fixtures are sold under the names of their respective manufacturers. Fleur-O-Lier label represents a *plus value* for the protection of ultimate users and is so accepted nationally. It will help you to build a future and grow with Fleur-O-Liers.

Names of FLEUR-O-LIER manufacturers are listed on this page.



Manufacturers of Certified FLEUR-O-LIERS

American Metalcraft Corporation.....St. Joseph, Mo.
Art Metal Co.....Cleveland, Ohio
Bright Light Reflector Co., Inc.....Brooklyn, N. Y.
Curtis Lighting, Inc.*.....Chicago, Ill.
Day-Brite Lighting, Inc.....St. Louis, Mo.
Eastern Fixture Co., Inc.....Boston, Mass.
Electro Mfg. Co.*.....Chicago, Ill.
Ender Mfg. Co.....New York, N. Y.
Fluorescent Equipment & Mfg. Co.....Cleveland, Ohio
The Frink Corporation*.....Long Island City, N. Y.
Sterling Bronze Corp.....Long Island City, N. Y.
Baron-Frink Lighting Corp.....Long Island City, N. Y.
Greenway Reflector Co.....Philadelphia, Pa.
Gruber Bros.....New York, N. Y.
Industrial Lamp Corp.....Chicago, Ill.
Infra Red Ray Devices Corp.....Clarkston, Mich.
Keystone Electric Mfg. Co.....Philadelphia, Pa.
Leader Electric Mfg. Corp.*.....Chicago, Ill.
The Wiremold Company.....Hartford, Conn.

Light Control Co.Los Angeles, Calif.
Lighting Products, Inc.*.....Highland Park, Ill.
Luminous Tube Lighting Co.....Chicago, Ill.
Markel Electric Products, Inc.....Buffalo, N. Y.
The Miller Co.....Meriden, Conn.
Mitchell Mfg. Co.*.....Chicago, Ill.
Ruby Lighting Company.....New York, N. Y.
L. J. Segal Company.....Chicago, Ill.
A. L. Smith Iron Co.Chelsea, Mass.
Solar Light Co.Chicago, Ill.
Spero Electric Corp.Cleveland, Ohio
Sun Lite Fluorescent Mfg. Co.....Detroit, Mich.
Tru-Ad Company*.....Los Angeles, Calif.
John C. Virden Company.....Cleveland, Ohio
F. W. Wakefield Brass Co.*.....Vermilion, Ohio
Wheeler Reflector Co.....Boston, Mass.
R & W Wiley, Inc.....Buffalo, N. Y.
H. E. Williams Products Co.Carthage, Mo.

Manufacturers of Certified Ballasts used in Fleur-O-Liers

Chicago Transformer Corp.....Chicago, Ill.
General Electric Co.*.....Fort Wayne, Ind.
Jefferson Electric Co.*.....Bellwood, Ill.
Sola Electric Co.....Chicago, Ill.
Westinghouse Elec. & Mfg. Co.....Cleveland, Ohio
The Wheeler Insulated Wire Co.....Bridgeport, Conn.
The Wiremold Co.....Hartford, Conn.
General Electric Co.*.....Schenectady, N. Y.

Manufacturers of Certified Starters used in Fleur-O-Liers

The Arrow-Hart & Hegeman Co.....Hartford, Conn.
The Bryant Electric Co.....Bridgeport, Conn.
General Electric Co.*.....Bridgeport, Conn.
Harvey Hubbell, Inc.....Bridgeport, Conn.
Instant Glow Starter Corp.....New York, N. Y.
Kuthe Laboratories, Inc.....Newark, N. J.
The Lloyd Products Co.*.....Providence, R. I.

* See advertisement in this insert section.

Participation in FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

FLEUR-O-LIER * * * TESTED * CERTIFIED * GUARANTEED

Here are the new *certified*

GRUBER

CURTIS

SUN-LITE

WAKEFIELD

TRU-AD

LIGHT CONTROL

LEADER

A. L. SMITH

ENDER

WILEY

ELECTRO

EASTERN

MITCHELL

WILLIAMS



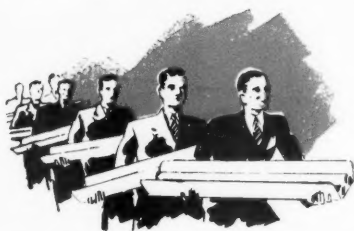
When you specify fluorescent lighting fixtures, get the protection this label gives

Shown here are some of the TESTED, CERTIFIED, GUARANTEED FLEUR-O-LIERS. Models of other FLEUR-O-LIER Manufacturers are now in the testing laboratories and will be released shortly.

FLEUR-O-LIERS

...with more to come

Grow with Fleur-O-Lier



The big idea back of these fluorescent lighting fixtures and the label they wear is **PROTECTION**—for you, for your customers. That's why so many leading fixture makers participate in the FLEUR-O-LIER program. The idea is practical . . . and scores of vital war plants are reaping the benefits.

For the label on each of these fixtures signifies that the unit has been *Tested* by impartial, independent experts (Electrical Testing Laboratories, Inc., of New York), *Certified* by them as meeting 50 definite standards set up by Mazda lamp manufacturers, and checked again at each factory four times a year by an E. T. L. inspector. What better safeguards of quality and lighting performance could a supplier and user ask for?

Extra Protection for You

FLEUR-O-LIER standards cover such important features as Certified starters and ballasts, flicker correction, high power factor, brightness control, high reflection factor, correct heat dissipation, maximum light out-

put, strength and rigidity, as well as WPB and Bureau of Standards requirements. Along with these are the **PLUS** features provided by individual manufacturers for additional user-benefits.

Wherever you're located, there's a FLEUR-O-LIER Manufacturer not far away. That means better service. And you can get FLEUR-O-LIERS on suitable WPB priorities.



Important for warplant offices and drafting rooms!

The August 18th amendment to L-78 removes the restriction against *manufacture* of "non-industrial" fixtures *after* December 1st, 1943. Consequently, FLEUR-O-LIER Manufacturers will make and supply "commercial" FLEUR-O-LIERS for warplant offices and drafting rooms. Sold on A-1-j, or higher, ratings . . . and complying with all WPB limitations on use of critical materials.

For further information, together with new booklet of FLEUR-O-LIER specifications and list of makers, write to FLEUR-O-LIER MANUFACTURERS, 2122-10 Keith Building, Cleveland 15, Ohio.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

FLEUR-O-LIER * * * TESTED * CERTIFIED * GUARANTEED

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

PLEUR-O-LITE ★ ★ ★ TESTED ★ CERTIFIED ★ GUARANTEED



Leader



**LIGHT
EASILY INSTALLED
FLEXIBLE INSTALLATIONS**

CORRUGATED



Unusual Strength

has been incorporated in the new Zephyrlite units through corrugation. Advanced design and engineering provides utmost strength and rigidity, insures installations against warping, twisting and sagging. Features never heretofore offered in the lighting field are incorporated in these advanced, industrial Luminaires.

These fixtures have been engineered and constructed to provide the maximum efficiency in installation and servicing, offering utmost economy in both initial and upkeep expenditures.

LEADER ZEPHYRLITE FEATURES

- Zephyrlite units may be installed flush against ceiling without requiring any hanging attachments whatsoever. Knockouts and connecting attachments provide continuous, uninterrupted wireway. Channel offers easy accessibility to wiring connections throughout entire unit.

- Corrugated bead in channel takes sliding hanger clamps for flexible installations and hanger clamps are adaptable for conduit, pipe, rod, chain or messenger cable mounting.

- All reflectors have trim, captive, knurled nuts, preventing loss of wing nuts in reflector servicing.

- Hanger brackets on side of socket box are adaptable for chain or rod suspension, spaced for level hanging.

- Removable rectangular knockouts make each unit a part of a continuous run installation if desired. Connecting couplers provide continuous wireway channel.

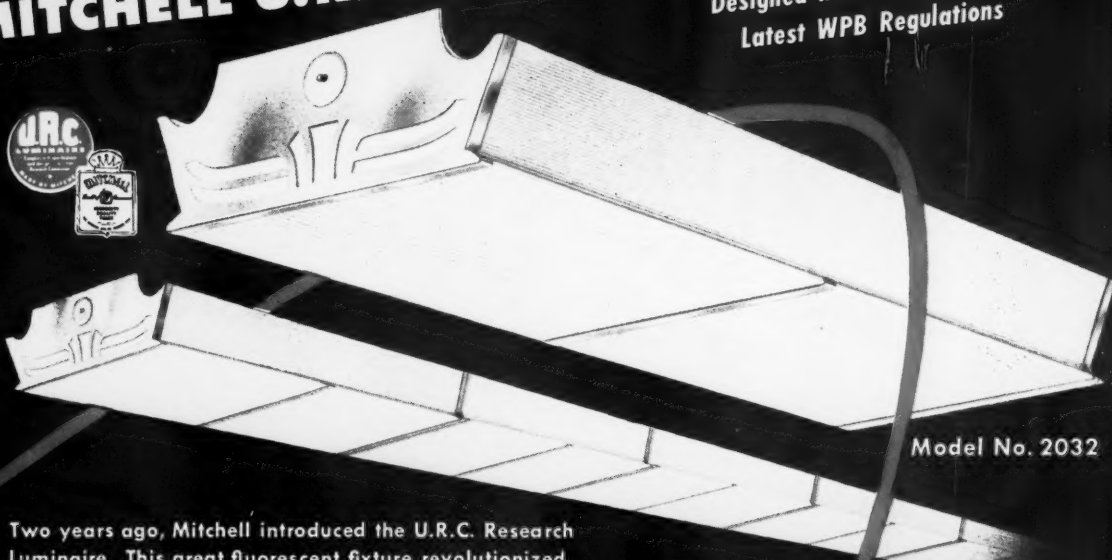
- Air cooled ballasts and easily accessible starters assure maximum operating efficiency.

- All Leader Zephyrlite units are constructed so that reflector louvers may be added at any time.

LEADER ELECTRIC MANUFACTURING CORPORATION
5112 Broadway Chicago 40, Illinois

AGAIN AVAILABLE *New Improved* MITCHELL U.R.C. RESEARCH LUMINAIRE

Designed in Accordance with
Latest WPB Regulations



Model No. 2032

Two years ago, Mitchell introduced the U.R.C. Research Luminaire. This great fluorescent fixture revolutionized commercial lighting, broke all sales records, became America's preferred unit. Today, stores, offices, buildings and institutions can again obtain it on a priority of A-1-J or higher . . . with all original U.R.C. lighting benefits, plus new Mitchell features. Combines the ultimate in high intensity illumination with low brightness! Adaptable for every type of interior—pendant or surface mounting, individual or continuous rows. Requires less time to install than any other commercial fixture. Lightweight—less than 6 lbs. of metal! Same low price as when originally introduced. Delivery after December 1st—place your order now!

Free! Send for Complete
Brochure and Lighting Calculator

Get the facts! Write to your Mitchell Distributor or to us for complete brochure giving full details and lighting data on the U.R.C. Research Luminaire—and for handy lighting "Calculator" which quickly estimates the number of fixtures needed for desired maintained footcandles in given area!

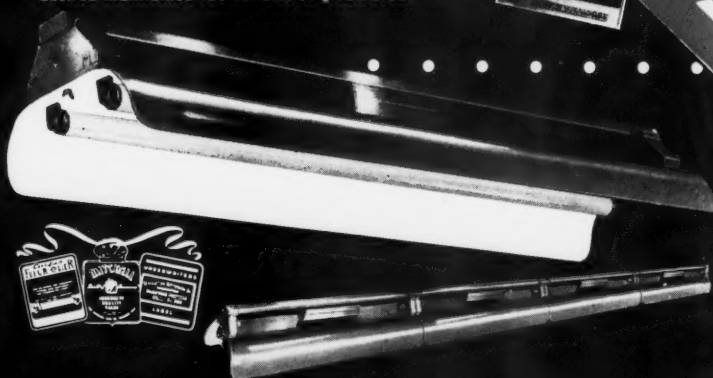


**MITCHELL
FLUORESCENT**

All-Purpose Mitchelite Fixture for War Plants

First "lightweight" unit to provide better, simpler, more flexible wartime lighting. Saves time installing and servicing—provides for every method of mounting or hanging. 3 "lightweight" models answer every need. 2 and 3-light units using 40-Watt lamps, 2-light using 100-Watt lamps. FLEUR-O-LIER APPROVED.

Write for Mitchelite Catalog No. 400



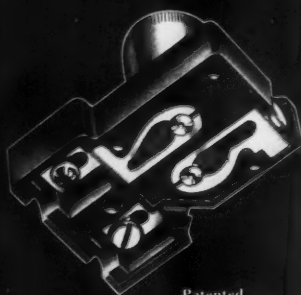
MITCHELL Manufacturing Company, 2525 Clybourn, Chicago 14, Ill.

FLEUR-O-LIER * * * TESTED * CERTIFIED * GUARANTEED

Demand Lloyd Products



Patented



Patented

LLOYD

Fluorescent Products

Each Lloyd unit is engineered for perfect fluorescent lighting service. Starters, starter sockets and lamp holders which set new standards of efficiency. They are specified repeatedly as the standard of quality and performance. Always specify Lloyd.

LLOYD STARTERS

Perfection in quick starting . . . in longer life . . . in service.

LLOYD STARTER SOCKETS

With the famous "Lobster Claw" Dual Lock Contact. Patented.

LLOYD TWIST TYPE LAMP HOLDERS

Absolutely simple. Absolutely foolproof. Absolutely secure. Patented.

LLOYD POLICY INSURES QUALITY

LLOYD PRODUCTS COMPANY

Providence 5, R. I.

REPRESENTATIVES

Geo. E. Anderson Co. Dallas, Tex.	H. W. Grotzinger Pittsburgh, Pa.	Max Lappin Cincinnati, Ohio
S. L. Bagby Company Charlotte, N. C.	Hawkins Electric Sales St. Louis, Mo.	Harvey M. Olmstead Denver, Col.
Nathan H. Bass Co. Milwaukee, Wis.	Rocke Internat'l El. Corp. New York, N. Y.	W. M. Sanderlin Co. Seattle, Wash.
David D. Blalman Philadelphia, Pa.	The Heilmann Company Minneapolis, Minn.	J. A. Sines Agencies Los Angeles, Cal.
Corey Company Inc. New York, N. Y.	C. C. Hillis Co. San Francisco, Cal.	Charles D. White Co. Boston, Mass.
Herman Gurley Bridgeport, Conn.	J. A. Jacques Co. Chicago, Ill.	Emdeca Products Co. Montreal, Que., Can.
Jules J. Dreyfus & Sons Miami, Fla.	W. D. John Detroit, Mich.	Cia. Lampares Electro de Cuba
George Eberhardt Lancaster, N. Y.	The Kilkenny Co. Cleveland, Ohio	Habana, Cuba (Cuba only)
Arthur Ehlers Cincinnati, Ohio		

Industries finest Lighting

FLUORESCENT "40-A SERIES"

*Look to L. P. L. for
all these features*

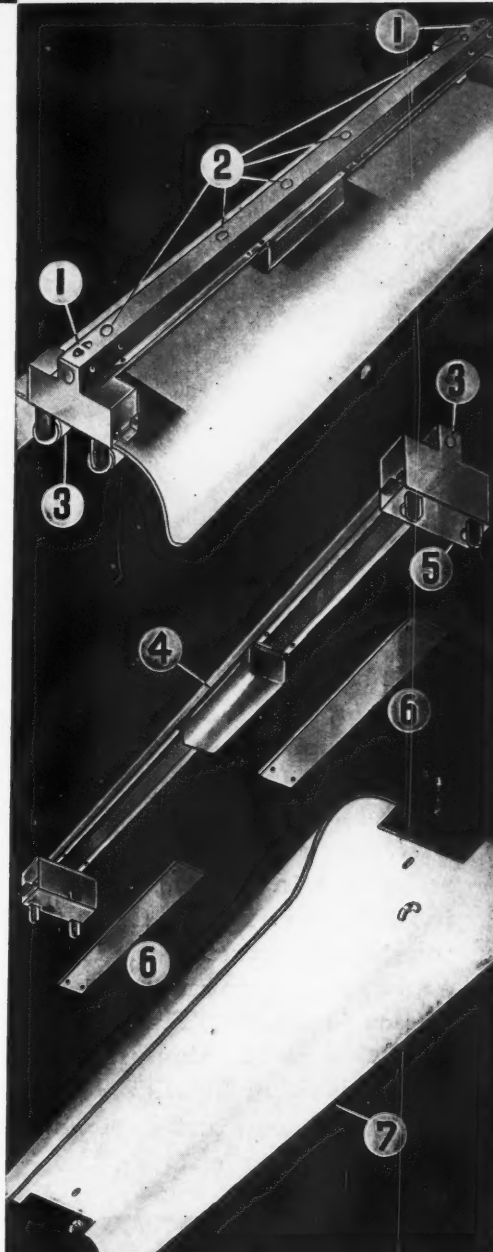
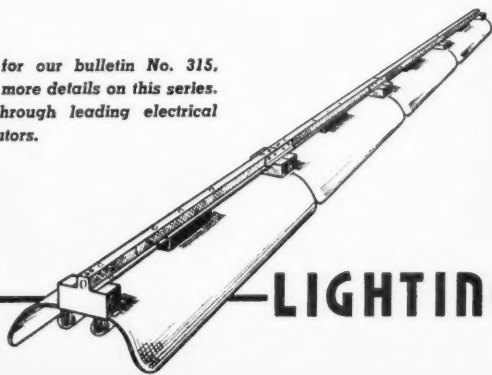
Every feature is included in this superb fixture not only to meet new government steel conservation orders but also to give you every advantage in installation and servicing.

- 1 A depressed chain hanging device allows any type of mounting, at no increased cost.
- 2 Knockouts on the top surface allow making any connections which are normally utilized in hanging fixtures. Eliminates accessories.
- 3 Knockouts on the ends of the wireways give direct straight runs for continuous wiring. Knock-out also provided in lamp holder cover for a Levolver Switch.
- 4 The ballast mounted in the open below the wireway assures cool and efficient operation.
- 5 The socket covers, fastened at the sides, allow easy access to the boxes for wiring or servicing.
- 6 Two removable wireway channel covers give free and easy access to all parts of the fixture interior. Simplifies installing.
- 7 Masonite reflectors are formed in our own factory under "Controlled Conditioning". A "Kladium White" reflecting surface assures maximum light output.

Continuous runs are easily accomplished by a simple coupling assembly.

Available in 2-40 watt, 3-40 watt, 4-40 watt, 2-100 watt and 4-100 watt.

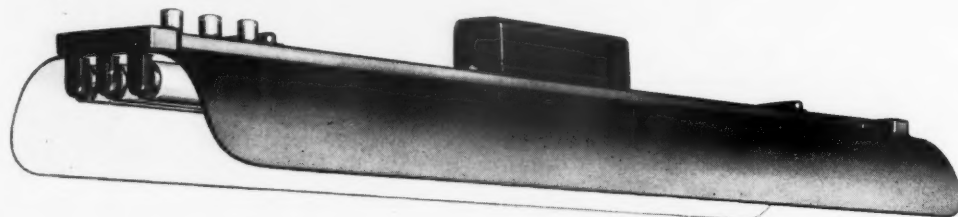
Write for our bulletin No. 315,
giving more details on this series.
Sold through leading electrical
distributors.



LIGHTING PRODUCTS, INC.
HIGHLAND PARK -- ILL.

FLEUR-O-LIER *** TESTED * CERTIFIED * GUARANTEED

PREDOMINANT! *Curtis* FLUORESCENT . . .



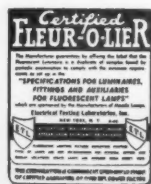
FOR SINGLE UNITS OR CONTINUOUS RUNS

It's surprising, the weight which the name Curtis carries when specifications are considered by the customer! Over four decades of progress have endowed this name with the prestige which lowers sales resistance in either fluorescent or incandescent field. On all those jobs where fluorescent is the logical answer . . . your logical choice is Curtis "Fluratex" . . . because . . . this unit is ideal for either individual or continuous run installations

. . . it satisfies WPB requirements . . . meets ETL specifications . . . bears the Fleur-O-Lier label . . . and is easily and quickly installed with a minimum of labor.

The user appreciates the low original cost and the economy of maintenance. Curtis Fluracite reflecting surface is easily cleaned and . . . stays white indefinitely.

Our new folder with full details, Serial 2149, is now ready . . . write for yours today.



Curtis LIGHTING, INC.

6135 WEST 65TH STREET . . . CHICAGO-38

INCANDESCENT *for* *High Efficiency Installations*

Still **THE FINEST INCANDESCENT REFLECTOR**

In spite of all the progress made by the lighting industry . . . nothing has yet topped the efficiency of Curtis Silver Mirror "X-Ray" Reflectors!

By all odds this is your best bet for incandescent general lighting jobs in the industrial field.

When you've simply got to deliver the most useful light per dollar and when you've got to watch time and maintenance costs . . . you'll find this unit the answer to your problem and . . . the customer's enthusiastic satisfaction!

A wide range of types and sizes available, accommodating 300 to 1500 watt incandescent lamps or 400 watt Mercury lamps. The 589-T shown above is just one of the types described in detail on our specification sheet, Serial 2132 . . . write for your copy today.



X-RAY
TRADE MARK REG.

**SILVER MIRROR
REFLECTORS**

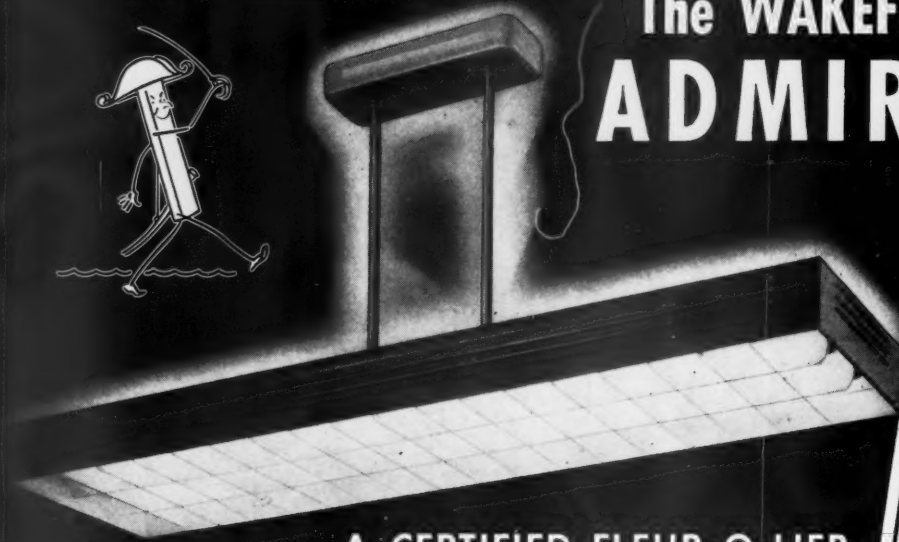
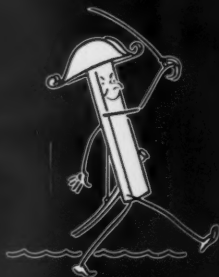
Curtis **LIGHTING, INC.**

6135 WEST 65TH STREET . . . CHICAGO-38

FLEUR-O-LIER * CERTIFIED * GUARANTEED * TESTED * * * * *

**"TOPS" to see by...and redesigned to
WPB limitations,**

**The WAKEFIELD
ADMIRAL**



A CERTIFIED FLEUR-O-LIER



For War Plant Office or Drafting Room

Redesigned to meet the metal weight-limitations of WPB, the Admiral is a natural for fluorescent lighting in offices and drafting rooms essential to the war effort. Sales require at least an A-1-j priority.

Made largely of wood, the Admiral conserves war materials and provides high intensity diffused lighting that helps office people handle today's heavy paperwork faster... with less eyestrain and fatigue.

It puts 90% of its light down on desk-tops or boards, allows the rest to go upward to avoid ceiling contrasts. That makes it especially

effective for work that involves critical seeing or for office space with poor ceilings. Incidentally, the Admiral's basic design has already been well tested by users, since only slight changes have been necessary to meet WPB requirements.

The Admiral is available in two, three and four lamp units. Let the Admiral help you speed war production for your customers by speeding their paperwork. Write for details.

**Back the attack
with War Bonds**



THE F. W. Wakefield BRASS COMPANY

RED SPOT LIGHTING FOR COMBAT OPERATIONS AND WAR PRODUCTION

VERMILION, OHIO

NO E
be m
thu
in the
LONG
ambie
specia
SAME
only i
plate
WIDE
watt
most
FOR M
ballast
Gener

Electr



Here's the ballast that helps save CRITICAL MATERIAL

Saves pounds per fluorescent fixture

NO ENCLOSURE REQUIRED. Because this new ballast with leads out the bottom can be mounted completely exposed, it requires only a shallow, narrow wiring channel—thus large quantities of steel, formerly required to house the complete ballast in the fixture itself, can be saved.

LONG BALLAST LIFE. And because of its exposed location, it will operate in lower ambient temperatures—which contributes to long ballast life. It does not require special installation features, such as ventilating louvers and conduction plates.

SAME HIGH QUALITY. This ballast differs from ballasts of the conventional design *only* in location of the leads, which come out through two bushed holes in the base plate—one at each end.

WIDE RANGE OF RATINGS. Ballasts with leads out the bottom are available in 40-watt Tulamp and three-lamp and 100-watt Tulamp and Forlamp ratings—those most popular for war-plant installations.

FOR MORE INFORMATION about this improved design, and for details on other G-E ballasts for fluorescent lighting, send for newly revised catalog GEA-3293. General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

Electrical Contracting, October 1943



BALLASTS FOR
FLUORESCENT
LIGHTING

★
The best investment in the world
is in this country's future—

BUY WAR BONDS

★
Hear the General Electric radio programs:
The "Hour of Charm" Sunday 10 p.m.
EWT, NBC "The World Today" news,
every weekday 6:45 p.m. EWT, CBS

FLUOR-O-LITE *** TESTED *** CERTIFIED *** GUARANTEED

TRU-GLO'S

FLAT TOP

Liberty Models

Conserves Steel!



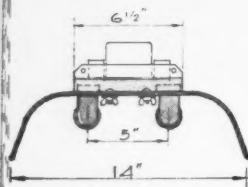
• IT'S •
CERTIFIED!

Fluorescent LIGHTING

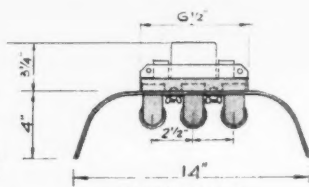
WITH NON-METALLIC

MASONITE REFLECTORS

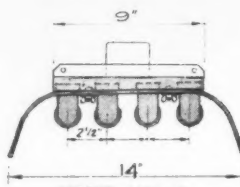
MODEL ILLUSTRATED 2032-48



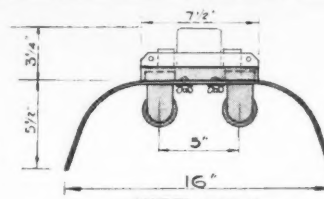
MODEL 2032-48



MODEL 2033-48



MODEL 2034-48



MODEL 2032-60

These TRU-GLO Liberty models comply with latest W. P. B. requirements and are constructed in two, three and four 40 watt and two 100 watt lamp units, utilizing solely ETL (Electrical Testing Laboratories) certified High Power-factor ballasts and equipment. Reflectors are of **Masonite** conforming to design and specifications of U. S. Bureau of Standards. The **Certified** hard oven baked-on white enamel finish produces a reflection value of over 83%; outside finish is gray baked enamel.

ETL CERTIFIED FLEUR-O-LIER

UNDERWRITERS APPROVED

UNION MADE

TRU-GLO Fluorescent Products have long been considered the foremost quality lighting equipment on the Pacific Coast.

Write today for further information. Representatives in principal western cities.

THE TRU-AD CO.

1019 N. MADISON AVE.

ESTAB. 1928

LOS ANGELES, CALIF.

TRU-GLO "WAR TIME" Fluorescent Fixtures

COMPLIES WITH
LATEST W. P. B.
REQUIREMENTS

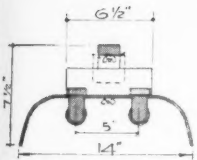


MODEL 2052-48

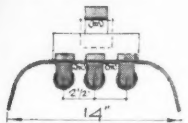
IT'S
CERTIFIED



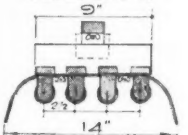
for INDIVIDUAL and CONTINUOUS Row Lighting



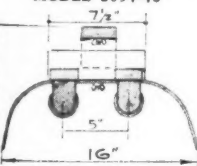
MODEL 2052-48



MODEL 2053-48



MODEL 2054-48



MODEL 2052-60

These Tru-Glo fixtures are practical and economical to install and combine all the features of higher priced models.

Reflectors are formed of Masonite in the approved design established by the U. S. Bureau of Standards. Finished in certified hard oven-baked-on white enamel, a reflection factor of over 83% is attained. Outside finish is of battleship gray baked enamel. The reflectors are held to the body by wing nuts and are easily removable for cleaning.

The wireway housing is finished inside and out in battleship gray oven-baked-on enamel. Ballasts, lamp holders and starter seats are fastened to the body and are easily accessible. Starters may be replaced without removal of lamps or reflectors.

Each unit is complete and may be used singly or for continuous runs; in the latter case, knock-outs in housing ends permit locking together any number of units. Knock-outs in top of housing are provided for conduit suspension. Openings in body permit chain suspension.

Control equipment - all parts are E. T. L. (Electrical Testing Laboratories) certified. Ballasts are high-power factor.



- GENUINE MASONITE "GUARANTEED" REFLECTORS
- E.T.L. & UNDERWRITERS APPROVED
- SUPERIOR STURDY CONSTRUCTION
- SIMPLIFIED WIRING CHANNEL
- HIGH REFLECTION VALUES
- MINIMUM USE OF STEEL
- UNION MADE

The men who install fixtures all testify to the outstanding quality and simplicity of installation and maintenance of Tru-Glo Fluorescent Products. Write us regarding our other industrial lighting models, Joblite, Utilite, Etc.

REPRESENTATIVES IN PRINCIPAL CITIES WEST OF THE ROCKIES.

THE TRU-AD CO.

1019 N. MADISON AVE.

ESTAB. 1920

LOS ANGELES, CALIF.

FLUOR-O-MASTER PRODUCTS CERTIFIED GUARANTEE

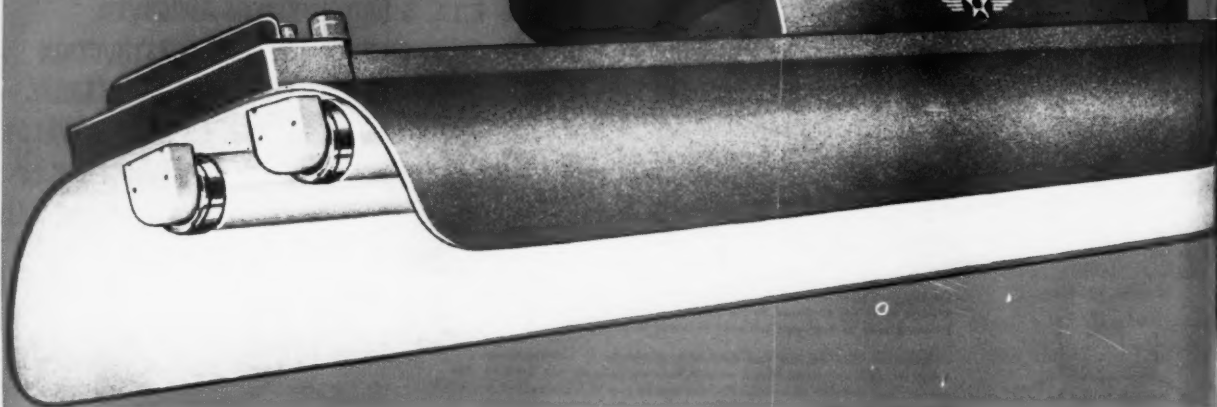
A NEW

Electro ENGINEERING TRIUMPH!



THE
METAL-SAVING

Fluor-O-Master
BOMBER



- CAN BE COUPLED FOR CONTINUOUS ROW INSTALLATION.
- BALLASTS ARE AIR-COOLED.
- STARTERS EASILY ACCESSIBLE.
- STURDY HANGERS, NUMEROUS

- KNOCKOUTS MAKE POSSIBLE ALL TYPES SUSPENSION
- REFLECTOR MAY BE QUICKLY DROPPED TO EXPOSE WIREWAY FOR SERVICING.
- U. L. APPROVED.

only

2 $\frac{1}{4}$

POUNDS OF METAL
IN MODELS FOR
40-WATT LAMPS



only

3 $\frac{1}{4}$

POUNDS OF METAL
IN MODELS FOR
100-WATT LAMPS

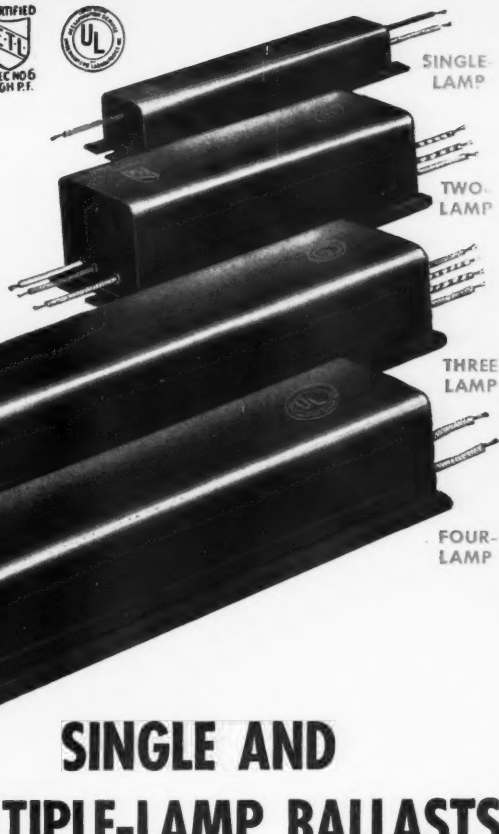
ELECTRO MANUFACTURING COMPANY

2000 WEST FULTON STREET • CHICAGO

Electric



CERTIFIED
EFC
SPEC NO 6
HIGH P.F.



To simplify fixture installations, Ballasts are available having the leads coming out of the bottom.

SINGLE AND MULTIPLE-LAMP BALLASTS

● Practically every fluorescent lamp installed today is providing illumination to assist in the production of badly needed planes, machines, tanks, engines,—combat equipment and war materiel of every kind. The satisfactory operation of these fluorescent lamps is essential, and this hinges to a great extent on the performance of one piece of equipment,—the Ballast.

At Jefferson Electric, the importance of the Ballast is well recognized,—and design, selection of all materials, construction and expert craftsmanship all contribute to the reliability for

which transformers and ballasts bearing the Jefferson Electric mark have long been known.

Save Critical Metals with Multi-Lamp Ballasts

Where groups of fluorescent lamps are installed, great savings in copper and other metals are possible by using Multi-Lamp type Ballasts. Costs are cut and installation time reduced. Four 100-watt lamps, for example, served by one

Four-lamp Ballast saves 50 per cent of the cold rolled steel, silicon, and copper required for two two-lamp 100-watt Ballasts. Too, power losses are reduced, and since four-lamp Ballasts may be used on 250-280 volt circuits, conductors can be smaller than for 110-130 volt circuits, another saving of copper.

Write for Bulletin 421-FL which carries full data. Recommendations of our engineers are yours for the asking . . . JEFFERSON ELECTRIC COMPANY, Bellwood, (Suburb of Chicago) Illinois. Canadian Factory: 60-64 Osler Avenue, West Toronto, Ontario.



FLUORESCENT LAMP BALLASTS

Electrical Contracting, October 1943

127

FLUOR-O-LIER * * * TESTED * CERTIFIED * GUARANTEED



Their **FRINK-SHEATHED** **SUPERCHARGERS** are the answer, Fritz!

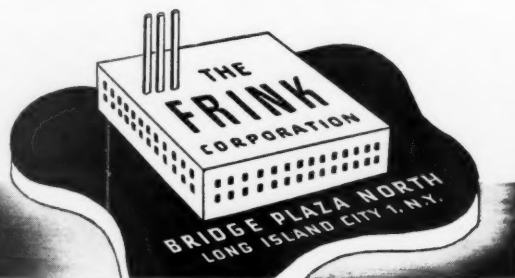
Newest fighter planes of the U. S. Army Air Forces are equipped with turbo-superchargers that enable them to outclimb Axis planes in combat. Attacking their adversaries from above, our pilots have the advantage that often means the difference between victory and defeat.

A vital part for these all-important superchargers is made by The Frink Corporation. The name Frink, though a relatively new name in the aircraft field, is an old and familiar one in the lighting industry. For 86 years Frink has meant expert engineering of lighting installations and precision manufacturing of lighting equipment. A pioneer in Fluorescent illumination, The Frink Corporation developed LINOLITE, the famous "engineered for vision" Fluorescent equip-

ment, installations of which are giving such efficient and profitable service in many of America's foremost factories, stores and banks.

Today Frink, together with other leading manufacturers, is heavily engaged in making implements of war. Tomorrow Frink will resume the high quality engineering and manufacturing of lighting equipment which have gained an enviable reputation for its products in the lighting industry.

"LIGHTING SINCE 1857"



Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation



HOW TO SAVE TIME

IN LIGHTING MAINTENANCE



The "Watch Dog," newest in the G-E line of fluorescent lamp starters, does not have to be removed every time a dead lamp is replaced—it remains in the fixture, ready to start the new lamp. This reduces the time spent in lighting maintenance. Further, it permits immediate replacement of dead lamps because no "cooling" period is required.

What's more, the "Watch Dog" is a precision lamp starter and a dead lamp stopper that ends blinking and flickering. Precision starting adds greatly to lamp life because it uses a minimum of emission material so vital to long lamp life.

FOR ADDITIONAL DATA SEND THE COUPON

Section G1034-8
Appliance and Merchandise Dept.
General Electric Company
Bridgeport, Conn.

Gentlemen: Please send me additional information about your new FS-40 "Watch Dog" Starter.

Name

Company

Address

City State

GENERAL ELECTRIC

FLEUR-O-LIER *** TESTED * CERTIFIED * GUARANTEED

RECOMMENDED BY THE U.S. GOVERNMENT



AS YOU NEVER DROVE BEFORE!

Many a soldier owes his life to a commander who drove him to the utmost in battle—*never let him slacken for a single fatal instant!* And after the war, many a worker will owe his economic safety to a leader who drove him continuously for higher Pay-Roll allotments for the purchase of War Bonds!

Despite higher taxes and prices, the average worker still has more money than ever before—particularly on the basis of the *family* income. With others in the family earning, too, just let the worker 'figure it out for himself', and he usually will realize that *now* he can

put more into War Bonds than he has been doing.

That's why the Treasury Department has set new quotas for the current Pay-Roll Allotment Drive—*quotas running about 50% above former figures.* These quotas are designed to reach the *new* money that's coming into the family income. Coming from millions of new workers . . . from women who never worked before . . . from millions who never before earned anything like what they are getting today!

The current War Bond effort is built around the *family* unit, and the Treasury Department now urges you to or-

ganize your War Bond *thinking*—and your War Bond *selling*—on the basis of your employees' *family* incomes. For details, get in touch with your local War Finance Committee which will supply you with all necessary material for the proper presentation of the new plan to your workers through your labor-management committees.

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. Great as this sum is, *it is not enough!* So turn-to today! Get this new *family income plan* working!



This Space Is a Contribution to America's
All-Out War Effort By

ELECTRICAL CONTRACTING

Electrical Contracting, October 1943

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seek greater recognition for the services and functions of the electrical contractors.

Appliances and Merchandising—Lou Gordon, Albert Lea; Sam Newstone, Montevideo; Ed Raetz, Rochester. This committee will investigate the possibilities of postwar development of the merchandising end of the electrical business, and aid in the plans for improving the electrical contractors' and dealers' place in the sale of appliances, lighting equipment, etc.

Employment—John Morris, Minneapolis; Paul C. Schorr, St. Paul; W. S. Johnson, Duluth. This group will study ways and means of assuring a more adequate electrical labor supply for war needs in Minnesota, and the development of stable employment in the postwar period—with particular concern for electrical men returning home from active service.

The general blueprint is for each of these committees to work independently, at first, in their respective fields. The work of all three will then be coordinated for a consolidated postwar Council program.

ORDER U-L-C AMENDED

Order U-l-c, which provides for the construction of electric service lines to productive farms, has been amended to further the use of materials available in the surplus inventories of utility companies. The use of certain sizes of composite electric conductor is permitted for the construction of rural lines which qualify under the terms of the order. Small additional amounts of copper also may be used in line construction where it will result in eliminating the need for additional transformers.

The amended order makes the following changes:

Primary lines are single phase and are constructed of:

- (1) No. 6 galvanized steel wire, or
- (2) To the extent that it is available

in the excess inventory of any producer,

- (a) Copper-covered steel wire,
- (b) Any composite-type conductor consisting of one or more strands of aluminum or copper wire stranded with one or more strands of steel wire (bare, galvanized, or copper-coated), having conductivity equal to or less than that of No. 4 copper conductor, or

(3) Any conductor having conductivity equal to or less than that of No. 6 copper conductor, which, after March 24, 1943, is salvaged from plant.

Secondary lines and services require:

(1) Not more than 30 pounds of non-ferrous metal in case a service transformer is installed as part of the construction, or

(2) Not more than 55 pounds of non-ferrous metal in case service will be rendered by an extension of secondary from a transformer already installed and in service.

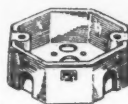
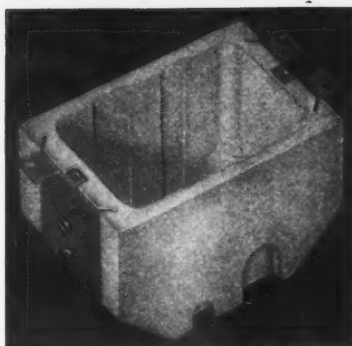
ANOTHER "E" FOR ARROWHEAD

Bill Johnson's Arrowhead Electric Company of Duluth, Minn., is stacking up the honors this year. A short while ago, this enterprising electrical contracting firm was awarded the Army-Navy "E" pennant for its work in wiring ships.

A second award was bestowed on the firm at a recent meeting of the Minnesota State Safety Council. Arrowhead Electric was first on the list of Minnesota contractors and industrial firms to be awarded an "E" flag for outstanding safety records. The presentation was made by Governor Ed Thye at a dinner meeting.

PRIORITIES REGULATION 3 AMENDED

Blanket preference ratings assigned for MRO purposes may be applied by persons eligible to use them for the repair of plant machinery and equipment, even if



Porcelain Meets WAR HOUSING Requirements for Non-Critical Wiring Materials

The War Housing Critical List, the Critical Materials Design Guide, the List of Prohibited Items for Construction Work, War Department Specifications—all require the use of non-metallic, or PORCELAIN Outlet Boxes and non-metallic type, or Knob and Tube Wiring Construction.

You can speed installation of every wiring job by stocking Porcelain Products' Porcelain Outlet Boxes, Surfolets Knobs, Tubes, Cleats and other non-metallic wiring materials.

Write for your FREE copy of Installation Manual on Porcelain Protected Wiring Systems.

PORCELAIN PRODUCTS, INC.
FINDLAY, OHIO



FISHER AIRCRAFT SUPERVISORS snapped just before the session on Electrical Equipment for military aircraft at the A.I.E.E. National Technical Meeting in Cleveland. They are left to right: C. S. Hegerling, R. E. Williams, R. G. Kohl and R. D. Walters.



Official U. S. Navy Photograph

Kaufmann-Fabry Photo

● For over 40 years this organization has been associated with Quality Commutators for every commercial and industrial need. Today our expanded production facilities are almost entirely devoted to the manufacture of commutators to fill priority orders on vital war products . . . particularly for electric motor manufacturers supplying the aircraft industry.

However, we are making every effort to maintain a stock of commutators for all popular size motors in 3 to 165 bars, brush diameters from .510" to 6.125".

Further, our organization plans to again serve its many friends in the motor repair industry and large industrial organizations. We are looking forward to the time when our Engineers will be more readily available for consultation and engineering services.

HIGH SPEED MOTORS REQUIRE HIGH SPEED COMMUTATORS

REPRESENTATIVES

ROBERT McKEOWN CO.	Newark, N. J.	INSULATION & WIRES, INC.	Atlanta, Georgia
H. A. HOLDEN CO.	Minneapolis, Minn.	ELECTRIC AGENCIES	Oakland, California
PHIL L. CAPY	Dallas, Texas	E. H. BELL	Los Angeles, California
H. O. HALE	Omaha, Nebraska	D. M. FRASER, LTD.	Toronto, Ontario
A. G. WERNER CO.	St. Louis, Missouri	UNIVERSAL ELECTRIC PRODUCTS CO.	Detroit, Mich.
HARRY B. CHAPMAN & SON	Detroit, Michigan	INSULATION & WIRES, INC.	St. Louis, Mo.
J. J. GLENN & CO.	Chicago, Illinois	TRI-STATE SUPPLY CO.	Los Angeles, Calif.
RICHARDSON ELECTRIC SUPPLY CO.	Seattle, Washington	JACOB P. WEBER	Chicago, Ill.
INSULATION & WIRES, INC.	Boston, Mass.	ELECTRICAL MAINTENANCE EQUIPMENT CO.	Philadelphia, Penna.

TOLEDO STANDARD COMMUTATOR CO. — Toledo 6, Ohio
HOMER COMMUTATOR CORP. — Cleveland 3, Ohio
HILLSDALE COMMUTATOR CO. — Hillsdale, Michigan

THE NATION'S LARGEST EXCLUSIVE MANUFACTURERS OF QUALITY COMMUTATORS

the repair job does not involve delivery of repair parts or materials, the War Production Board ruled through the issuance of Priorities Regulation 3, as amended.

Blanket MRO ratings are assigned by CMP Regulations 5 and 5A, certain orders in the "P" series, and certain other WPB orders and regulations and on forms and certificates where the kind and quantity of this material to which the rating may be applied is not specified. In any case where the quantity of material is specified in terms of dollar value only the preference rating is a blanket MRO rating.

Ratings assigned on PD-1A, and PD-3A certificates and other ratings assigned to the delivery of specific repair parts or materials may also be applied to installation of the parts or materials or to the repair job alone if it is found that installing the parts and materials is not necessary. However, in the case of ordinary plumbing, heating, electrical, automotive, or refrigeration repairs, a rating may not be applied to repair work even if it is expressly applicable to repair parts or materials.

For the purpose of this part of the order, repair means to fix a plant, machinery, or equipment after it has broken down or when it is about to break down. It does not include upkeep or maintenance service such as periodic inspection, cleaning, painting, lubricating and other services.

Ratings for repairs, as distinct from delivery of repair parts or materials, may be applied only to persons regularly engaged in the business of making such repairs with their own tools and equipment.

Persons who have received a preference rating for the use of facilities only or for a repair job only, where no delivery of materials is involved, may not extend the rating for any purpose.

The regulation also provides that blanket MRO ratings may not be applied to get any item included in List B of the regulation. Suppliers are prohibited from giving any effect to ratings applied to deliveries of any item on List B if they know or have reason to believe that it is a blanket MRO rating. Ratings which are not blanket ratings may, however, be used to obtain List B items.

The item on List B which covers laboratory instruments and equipment has been amended to permit the use of ratings assigned pursuant to Orders P-56, P-58, and P-73, relative to the mining industry.

GENERAL LIMITATION ORDER L-39 AMENDED

Further restrictions on the manufacture and distribution of certain fire protective, signal, and alarm equipment are imposed by General Limitation Order L-39 as amended by the War Production Board. The order also liberalizes the distribution of electrically or pneumatically controlled fire sprinkler equipment by permitting installation of equipment rated AA-5 or higher without specific authorization by

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WPB when it is to be used for the following purposes:

1. Protection of transformers, other oil-filled electrical equipment or dip tanks if the equipment installed uses spray heads;

2. Protection of powder rolls in plants manufacturing explosives;

3. Protection of modification hangar rooms and hangar rooms of aircraft assembly plants where the highest sprinkler head is 35 feet or more above the floor.

Among the other important changes made by the amended order are the following:

Control over the sale and delivery of signal and alarm equipment and air raid warning devices is tightened. Application for specific authorization of purchase orders, as required by the order, is now made on Form WPB-1319 (formerly PD-556). This form calls for detailed description of the equipment or device for which application is made; the name of the manufacturer from whom it is to be purchased; and information on why the equipment is needed. Application may be filed only by the person who is to receive the equipment or have it installed on his premises, not by the supplier.

The permitted uses of copper and copper base alloys are extended, permitted uses of other scarce materials are modified, and restrictions on the use of lead are rescinded by changes in the order.

NAWB HAS PLAN TO AID BUILDERS IN POSTWAR

The electrical industry, through the National Adequate Wiring Bureau, has announced a national plan to aid builders of postwar homes meet the inevitable public demand for wiring systems that will more satisfactorily operate their electrical equipment.

"How to keep their electrical appliances operating during wartime has been a major problem in millions of American homes," declared Herbert Metz, Bureau chairman. "Electrical trouble, caused by overloaded house wiring buried in the walls, floors and ceilings, is making householders realize that the electrical installation was not properly designed in the first place."

Through the plan of the NAWB build-



DU PONT ENGINEERS attending the A.I.E.E. National Technical Meeting in Cleveland are: H. E. Houck, electrical engineer (left) and A. M. Hamann, engineering assistant in the electro-chemical department.

QUALITY CONTROL

of All *Pedigree*

Electrical Insulating

VARNISHES

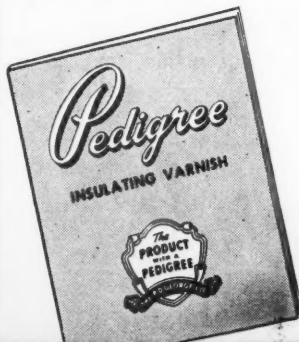
Means

MAXIMUM LIFE

At MINIMUM COST

for Your

ELECTRICAL EQUIPMENT

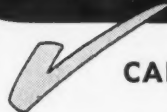


Write for this catalog
of varnish facts today



The P. D. GEORGE CO.

5200 N. Second St. • St. Louis 15, Missouri



**CALL IN THE PEDIGREE VARNISH
MAN NEAREST YOU**

Have you transformer troubles?

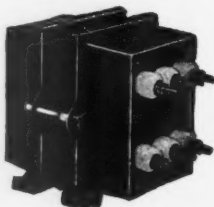
TRY

Newark TRANSFORMERS

Standard or Special



Oil Cooled Transformer
for Plate Supply Furnace,
Welding, etc.



For Electronic
Applications

If your difficulties involve transformer performance, why not use our twenty years of experience to iron them out. If the job calls for a standard dry type transformer, you will find just what you need in the NEWARK line. If it is a special transformer job, you will find in the NEWARK staff the brains and experience to design the transformer you need, and in the NEWARK shops the components required to assemble it, and the skilled workmanship to do it right.

Are your difficulties based on delayed deliveries? Well, the reputation of NEWARK for unusual delivery always has been good, and still is. Let us confirm this, on your job.

Full details on Newark Transformers, Dry Type or Oil Cooled Distribution Type, in descriptive bulletins on request.

Newark

TRANSFORMER CO.
17 FRELINGHUYSEN AVE.
NEWARK, NEW JERSEY

OUR SUBCONTRACT FACILITIES may be just what you need to meet delivery needs on war production. We established this department long before Pearl Harbor, and it is skilled in handling all kinds of work, not only electrical in character.

Phone: BIGELOW 3-5600

NEWARK TRANSFORMER CO.

17 Frelinghuysen Ave.

Newark, N. J.

ers will be able to assure their postwar buyers that the homes they build meet the minimum demand for adequacy in the electrical installation. This fact will be evidenced by a certificate issued by local electrical groups under the authority of the Bureau. The certificate will indicate the special provisions made in the installation for operating electrical appliances and other electrical equipment as they become available for practical and economical use in the home.

This service of the electrical industry will be available to builders through local adequate wiring bureaus, electrical associations and other groups.

STREED SUCCEEDS FRYKMAN

S. Martin Streed of the Minneapolis electrical inspection department was recently appointed chief electrical inspector for the city, succeeding Oscar M. Frykman who retired on August 1.

Mr. Streed's background in the electrical field gives him a solid foundation for his new duties. He was successively, helper, journeyman and master electrician for various Minneapolis electrical contractors from 1914 to 1921 when he was appointed electrical inspector with the city building department of Minneapolis.

In addition to his inspector activities, he also has been associated with the evening school of the Dunwoody Industrial Institute since 1925, where he teaches the National Electrical Code and wiring design for light and power.

WPB SURVEYING ELECTRONIC TEST EQUIPMENT

To meet increasing requirements of the armed services for electronic test equipment, a plan for wider subcontracting of orders for critical test equipment, test



OFFICIAL DELEGATE at the A.I.E.E. National Technical Meeting in Cleveland is R. F. Snyder, president of the Akron section and electrical engineer for the Goodyear Tire and Rubber Company. Electrical maintenance and design of electrical control on production machinery are among Bob's duties for Goodyear.

Electrical Contracting, October 1943

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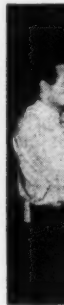
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instruments and component parts has been initiated by the Radio and Radar Division of the War Production Board.

Two surveys have been launched by the Radio and Radar Division in its plan to place this extra demand on the test equipment industry in places where facilities and competent personnel already exist, since the expansion of facilities is impractical for lack of time, construction materials and new personnel.

Regional offices of WPB have been requested to furnish detailed reports on manufacturers and facilities available for prime or sub-contracts for producing test equipment, test instruments and components. At the same time, each manufacturer of electronics test equipment has been asked to indicate which firms would be most capable of adapting themselves to produce, under sub-contract, items for the manufacturer's schedule.

In a letter to manufacturers of electronic test equipment, Ray C. Ellis, Director of the Radio and Radar Division, stated that the armed services have given notification that requirements for test equipment needed to manufacture, install, maintain and service equipment for the future will increase substantially.

There are several ways of alleviating shortages of test equipment by subcontracting, the letter says in part. Suggested items for sub-contracting include:

- (1) Those models having relatively small volume of sales. This releases productive capacity for the large volume models requiring the prime contractors' special skill;
- (2) A part or all of the order for a model having a large backlog;
- (3) Component parts.

APPLICATIONS FOR UTILITY EXTENSIONS SIMPLIFIED

The Office of War Utilities has issued a new order, U-1-f, permitting utilities to grant extensions without filing applications with Washington when the restrictions of the order are met. This implies no relaxation of the restrictions, but eliminates processing of eight to ten thousand appli-



ENGROSSED IN A DISCUSSION of electrical equipment in military aircraft are these engineers attending the A.I.E.E. National Technical Meeting in Cleveland. They are left to right: E. H. Medley and C. H. Spetter, Lear Aviation, Inc.; and L. W. Buell, Spencer Thermostat Co.

Electrical Contracting, October 1943

TIME-SAVING FEATURES OF J-M TRANSITE DUCTS--NO.4

EASY HANDLING!

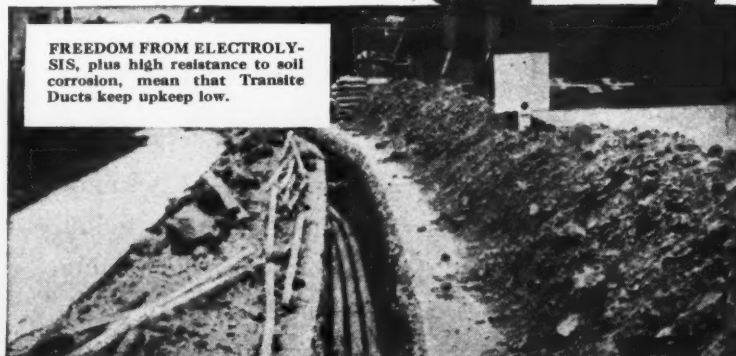
CREWS like to work with Transite Ducts, because these modern cableways are supplied in long, light lengths that make handling easy and rapid. The assembly method is so simple that even unskilled crews can do fast work. No screwing or threading is needed. Lining up is fast and accurate.

And, on the job, these asbestos-cement ducts won't rot, can't burn, effectively resist corrosion, help assure permanently low maintenance costs.

For details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York 16, N. Y.



FREEDOM FROM ELECTROLYSIS, plus high resistance to soil corrosion, mean that Transite Ducts keep upkeep low.



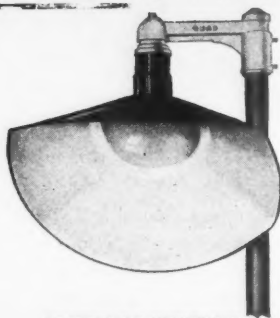
Johns-Manville TRANSITE DUCTS

TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

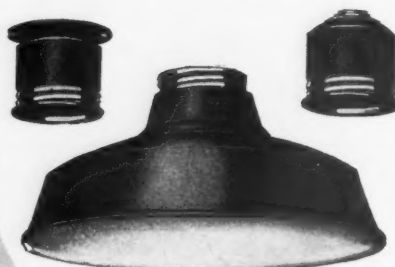
TRANSITE KORDUCT . . . for installation in concrete. Thinner-walled, lower-priced, otherwise identical with Transite Conduit.

QUAD

LIGHTING UNITS



ADJUSTABLE PORCELAIN
ENAMELED FLOODLIGHT



No. 1184-M
RLM THREADED
DOME REFLECTOR



★ QUAD Lighting Units have unlimited possibilities . . . for good business and good lighting. The stress placed on specialized lighting today demands the most modern and most flexible lighting units—QUAD Units fill the bill for these requirements, no matter how exacting. Be ready for any industrial or commercial lighting job with QUAD Units.

QUAD—for today and for tomorrow—

QUADRANGLE MFG. COMPANY

Mfgs. of Incandescent and Fluorescent Lighting Equipment
32 SO. PEORIA ST. CHICAGO, ILL.



DESPITE THE SWELTERING HEAT, discussions continued long after adjournment at the A.I.E.E. National Technical Meeting in Cleveland, Ohio. Above, left to right are: Walter Rupprecht, Supt. electrical department, Dow Chemical Company and J. H. Cox, Westinghouse Mercury Arc Rectifier engineer.

cations a month, most of which have been granted as a matter of necessity.

Under the new rules, domestic consumers seeking extension of electric, gas or central heating service must be located in a critical housing area as determined by the National Housing Administration. Water consumers need not be in one of these areas, as long as other restrictions of the order are met.

Industrial and commercial consumers must be engaged in an essential activity as defined in Schedules I and II of CMP Regulation 5. The cost of the extension must not exceed \$1,500 for underground construction or \$500 for other construction.

The new order does not apply in any case where construction or renovation is involved costing more than \$200. In these cases, permission for construction must be obtained under Order L-41 and the utility construction is governed by Order U-1-d.

SCHOENINGER IS NEW DETROIT CHIEF

The position of chief electrical inspector of the city of Detroit, left vacant by the retirement of James Galbraith, was recently filled by the appointment of Carl Schoeninger.

Prior to his appointment, Mr. Schoeninger was assistant electrical engineer of the Department of Water Supply, City of Detroit.

CONSERVATION PROGRAM REQUESTED

Every industrial and commercial plant in the nation, as well as every private citizen, has been asked to adopt at once a broad conservation program to save criti-

Electrical Contracting, October 1943

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cal resources of manpower, fuels, material and equipment.

The request has been made by Donald M. Nelson, chairman of the War Production Board; Joseph B. Eastman, Director of the Office of Defense Transportation; and Harold L. Ickes, Administrator for Solid Fuels and Petroleum Administrator for War, as the government inaugurated the new program for voluntary savings.

Opportunities for conservation in the electrical field are by a nationwide reduction in the use of display lighting, by eliminating unnecessary use of lights and electrical equipment in homes, stores and factories. It is estimated that a 10 percent reduction in domestic and commercial use of electricity would save over 4,000,000 tons of coal or its equivalent and more than 75,000,000 lamp bulbs.

Electricity is to be saved through the turning off of lights and appliances not needed. Stores and other establishments are asked to eliminate their signs and window and display lighting during the daytime and to limit such lighting to a short period between dusk and 10 p.m.

INSPECTOR PARKER RETIRES

The end of this year will mark the retirement of Ralph T. Parker as inspector of wires, Pittsfield, Mass. Retirement, in accordance with local ordinance is compulsory at the age of 70.

Mr. Parker spent more than a quarter of a century as electrician for various contractors, then entered the field of plant electrical maintenance. He was appointed wire inspector for Pittsfield in 1924 and has held this position since that time.

VANCOUVER, B.C. INSPECTOR RETIRES

Thomas Martin, city electrician for Vancouver, B. C., recently retired following 30 years of service with the city. L. H. Miller, chief inspector in the civic



AIRCRAFT ELECTRICAL ENGINEERS at the A.I.E.E. National Technical Meeting in Cleveland, Ohio. Left to right they are: George M. Kohler, Curtiss-Wright Corporation; S. W. Zimmerman, General Electric, and Alfred Skrobisch, Eastern Air Devices Inc.

"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

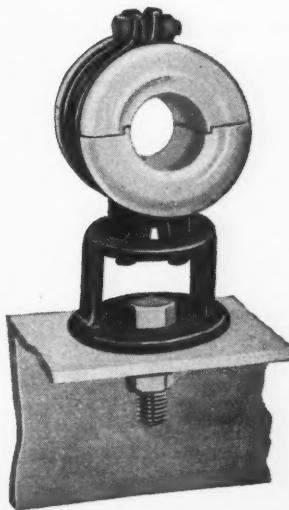
EFFICIENCY INSULATOR SUPPORTS

Indispensable for many installations on open steel construction... eliminates drilling or burning holes!



Designed for a variety of uses, the EFFICIENCY Insulator Rack may be mounted in three different positions to meet various needs. Its construction is such that no holes need be bored for mounting. Note that the extra heavy head is drilled for a set-screw to slip through and tighten on a steel nut. This feature insures that the Support will last indefinitely, for should a stripped thread occur, it is only necessary to replace with a common steel nut. This Support-Type X is available for cable diameters from 1" to 2".

At the right is EFFICIENCY Adjustable Bushing Support... a convenient independent mounting. This design requires only one bolt to be tightened to hold porcelain bushing and clamp to base. Bushings are split-design to reduce power leakage and are completely surrounded by metal. The circular base is adjustable to any angle required for the conductors. The EFFICIENCY Adjustable Bushing Supports are available for cable diameters from 5/16" to 2-3/8".



Write today for your copy of our catalog No. 38A... contains complete construction and application data on all EFFICIENCY Devices.

Efficiency
ELECTRIC AND MANUFACTURING CO.



MANUFACTURERS OF EFFICIENCY
ELECTRICAL DEVICES FOR CONDUIT,
WIRE AND CABLE SUSPENSION



Look at the Features

1. Small in diameter — Saves space.
2. Superaging — Long life, no oxidation
3. Easy pulling — Hard, smooth finish
4. Heat resistant — Rated 60 deg. C.
5. Free stripping — Speeds splicing and soldering
6. High dielectric strength — 720 volts per mil, test result
7. Flame proof — Will not support combustion
8. Insulation — Tensile strength of 2000 lb. per sq. in., test result
9. Many colors — Same range as Type R wires
10. Oilproof — Unaffected by oils, water, acids, alkalies
11. Attractive — Retain fine appearance
12. Self-protecting — No braids necessary

Flamenol Building Wire is available now in sizes 14 to 1,000,000 CM. (Resins are permitted for electrical conductor insulation wherever copper is allocated.) Use this wire for the war-purpose jobs you are handling. It is easy to use and will give long service.

For further information see the nearest G-E Merchandise Distributor or write to Section W-1031-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

electrical department for the past 18 years, was appointed to fill the vacancy as acting city electrician.

After working for an electrical firm, Mr. Martin joined the city in 1913 to work on ornamental street lighting. He followed his hobby of illumination winning numerous citations.

REPAIR MATERIAL FOR ESSENTIAL EQUIPMENT

Steps have been taken by the War Production Board to facilitate more prompt emergency maintenance and repair service for essential industrial and commercial refrigerating and air conditioning systems. Preference Rating Order P-126 as amended simplifies procedure for obtaining repair parts and materials, and also removes the provisions which limit the use of preference ratings to service agencies holding certificates of authority issued by WPB.

The amended order defines a service agency as any individual or firm which engages in repairing systems belonging to others. It assigns preference ratings and CMP allotment symbol MRO to purchase orders for maintenance and repair parts and materials placed by any service agency, according to uses of the systems for which they are needed. Systems and applicable preference ratings are:

Class I: AA-I—MRO, for systems used in industrial food manufacturing, processing, packaging, preservation, storage or transportation, or for purposes listed in Schedule I of CMP Regulations 5 and 5A.

Class II: AA-2—MRO, for systems used in restaurants, hotels or retail stores, exclusive of air conditioning systems; in milk cooling on farms; or purposes listed in Schedule II of CMP Regulation 5 and 5A. Also in Class II are parts and materials needed to build up the service agency's inventory to the largest permitted amount.

Class III: AA-5—MRO, for systems (except air conditioning) used for purposes not listed in Schedules I and II of CMP Reg. 5 and 5A or in Class II.

Controlled materials for Class III uses may be bought only with special WPB permission; application is made at local WPB offices on Form WPB-541 (formerly PD-1A). Controlled materials for repair and maintenance of Class I and II systems may be bought with the preference ratings designated with the exception of aluminum. This must be obtained in accordance with the provisions of CMP Reg. 5 and 5A.

To permit newly established service agencies to maintain sufficient inventories, former inventory limits based on 1941 inventories have been changed. A service agency may build up an inventory, estimated in dollar value, needed to continue emergency repair service for a 60-day period.

CONSERVATION ORDER M-199 AMENDED

Amendment 1 to Conservation Order M-199 prohibits any further use of foreign silver in the manufacture of brazing alloys or solders. However, manufacturers may complete processing of any

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foreign silver already in process, or use up one month's supply of the total foreign silver which was on hand on July 29. Stocks on hand may be delivered to any users for end products not appearing on list B.

MANUFACTURERS NEWS

GENERAL ELECTRIC CHANGES

E. H. Howell, manager of General Electric Company's Toledo office for the past 13 years, has been appointed manager of the Company's Meter and Instrument Division. Mr. Howell succeeds W. F. Howe, who is relinquishing his responsibilities but will continue as a full time consultant of the division.



HOWELL

S. J. Tombaugh of Cleveland has been named manager of the Toledo office, succeeding Mr. Howell. W. F. Rauber has been appointed manager of sales of G-E's Outdoor and Station Equipment Section.

The Resin and Insulation Materials Division of General Electric's Appliance & Merchandise Department has moved its sales and order service headquarters office to Schenectady, N. Y. from Bridgeport, Conn.

OWENS-CORNING OPENS NEW FACTORY

The Owens-Corning Fiberglas Corporation is opening a new plant at Huntingdon, Pa. This plant will produce glass fiber textiles used in plane construction and for the insulation of airborne electrical equipment.

Manager of the new Pennsylvania plant will be Marshall Burch, now superintendent of the company's Newark, Ohio factory. John Saalfeld, now of the company's Toledo general office staff, will be production superintendent. Walter Aikman, also of the Toledo staff, will be plant engineer.

Personnel director will be Alva B. Walton, now employment manager at the Newark, Ohio, factories. Other Huntingdon plant appointments from the Newark factories' personnel are: John R. Zirkle to be industrial engineer, Kenneth L. Sullivan to be service manager, Daniel R. Hunter to be purchasing agent, Robert R. Schenk to be product control supervisor.

C. R. Moore will be transferred from the Ashton, R. I., plant to serve as accounting and budget supervisor.



PERMAFLECTORS WILL SOLVE YOUR LIGHTING PROBLEM

● Light is a production tool. Many plants find better lighting the answer to better production. The ease, speed, and economy of installing PERMAFLECTORS for General, Supplementary, or Localized lighting is only surpassed by their highly efficient lighting performance.

*Engineered
Light Control*

● PERMAFLECTORS are "shaped mirror" of silvered glass - so designed as to pick up the maximum flux of light and lay it where you want it. There is a size and shape for every purpose.

*Quick, Easy
Installation*

● PERMAFLECTORS are ready for service, simply by connecting wiring. They may be mounted from 6 to 60 feet, and more, above the work level - for concentrated, medium, or broad light distribution.

*Low Cost
Efficiency*

● PERMAFLECTORS are low in first cost . . . deliver "useful" light more efficiently . . . stay clean longer . . . deliver dependable lighting service at minimum cost over a long period of years. PERMAFLECTORS may afford THE solution to YOUR LIGHTING PROBLEM. Investigate.

PITTSBURGH REFLECTOR CO.

MANUFACTURERS OF LIGHTING
EQUIPMENT AND THE FAMOUS

Permaflectors

OLIVER BLDG. PITTSBURGH PENNA.

Please send Industrial Lighting Supplement

No. 2. EC10-43

Name

Company

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THE NEW MODEL 590

VOLTAGE TESTER

READS LIKE A THERMOMETER!!



Automatically Indicates

- Whether the voltage is 110, 220, 440 or 660 Volts.
- If the current is A.C. or D.C.
- If the appliance, motor, etc., connected in the line is "open."
- Which leg is "grounded."
- If the frequency is 25 or 60 cycles.
- If the fuse is "blown."
- When one side of an appliance or motor connected to the line under test is "grounded."
- Excessive leakage between a motor and a line.
- When a three phase motor is running erratically due to a "blown" fuse.

NO METER, NO SWITCHING, NO TIP JACKS. To use: simply connect the needle pointed test prods across any line and this truly versatile instrument will instantly indicate the Voltage, Frequency, type of Current, etc. Rugged, dependable and efficient, this amazing electric tester measures only 1 1/4" x 5" x 1 1/4" and weighs only 5 ounces. Four individual GE type NE-7 neon bulbs used in conjunction with a network of resistors provide most of the services necessary for all industrial electrical maintenance. Unlike most electrical testing instruments which necessarily require a great amount of care, the Model 590 is designed for "bang around" maintenance work, and yet due to the unique design it compares favorably in sensitivity with expensive metered instruments in that it draws less than 1 Milliampere of current.

Model 590 comes housed in a beautiful hand-rubbed wooden cabinet. Panel is of etched steel. Shipping weight 2 pounds. Complete with instructions.

ONLY
\$585

SUPERIOR INSTRUMENTS CO.

Dept. E. C.

227 Fulton Street, NEW YORK, N. Y.



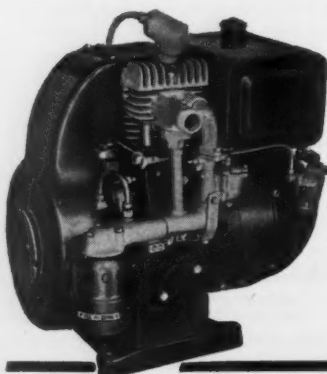
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ELECTRIC PLANTS

Electricity for Any Job—Anywhere

ONAN GASOLINE DRIVEN ELECTRIC PLANTS provide electricity in any location where it is not otherwise available, and for emergency and standby service.

Thousands of these reliable, sturdy plants are doing a winning job



on all the fighting fronts by providing power and light for many vital war tasks.

Ratings from 350 to 35,000 watts. A.C. 50 to 800 cycles, 110 to 660 volts. D.C. 6 to 4000 volts. Also dual A.C. and D.C. output models. Air or water cooled engines.

Details gladly furnished on your present or post-war need for Electric Plants.

D. W. ONAN & SONS
2082 ROYALSTON AVE. • MINNEAPOLIS, MINN.

BROWN COMPANY ELECTIONS

The Brown Company, Berlin, N. H., announces the election of Frederic G. Coburn of New York City as president of the Company. Mr. Coburn has been associated with Brown Company for the past eight months as special assistant to H. P. Kendall, who as chairman of the board served as chief executive pending the election of a president.

Other officers were reelected as follows: E. H. Maling, vice-president in charge of finance and accounts and treasurer; W. L. Campbell, vice-president in charge of manufacturing; H. E. Houghton, vice-president in charge of sales; R. W. Bowlen, assistant treasurer and assistant secretary; R. H. Marshall, comptroller; J. B. Hopkins, secretary; and L. A. Pierce, Clerk.

Cutler-Hammer, Inc., Milwaukee, announces the appointment of P. S. Jones as general sales manager. Mr. Jones



JONES

first became associated with the company at Milwaukee as a sales engineer in 1915, and he was transferred to the Pittsburgh office in 1919, where he was later appointed as branch manager of the Pittsburgh Sales territory. For the past 14 years, he has been in charge of the New York sales territory.

GRAYBAR APPOINTMENTS

Norman M. White was appointed district operating manager at the Dallas office of Graybar. He was formerly service manager at St. Louis.

J. R. Ernest was appointed district operating manager at St. Louis, succeeding Mr. White.

Trico Fuse Mfg. Co., Milwaukee announces the appointment of the Southeast Engineering Co., 2056 Post St., Jacksonville 1, Florida, as representatives of their complete line in the states of Florida, Georgia and Alabama.

Westinghouse Electric & Manufacturing Company has named John J. Nielsen, an application engineer, as plastics specialists for the Los Angeles area. Mr. Nielsen was transferred to Los Angeles from Trafford, Pa.

Pittsburgh Reflector Company announces the appointment of H. D. Siler as manager of the New York office.

Electrical Contracting, October 1943

MORE GOSSIP

Fuse Tamperer Nipped

A fellow in Hamilton, Canada, sat cooling his heels in jail carefully pondering the seriousness of tampering with fuses. According to George W. Howse, Hydro-Electric Power Commission, Hamilton, Canada, this fellow persisted in tampering with fuses in spite of several previous warnings. His persistence landed him in police court and brought him a \$30 or 30 day verdict.

Local newspaper publicity brought out the seriousness of the act. This was the second successful prosecution of such a case—a vivid indication that electrical safety is not taken lightly up there.

Nothing But Woe

Burglars have no respect for the anguish that electrical contractors bear to secure wiring materials under present conditions—at least not in Chicago. If they had, they wouldn't have entered an unfinished house in a Chicago defense housing project and blithely left with \$400 worth of electrical materials. It's tough enough to get the stuff nowadays. But when someone steals it—well, that's the proverbial last straw.

Milwaukee Inspector Retires

John A. Poehlmann, electrical inspector for the city of Milwaukee, Wis., recently retired from active duty after 28 years of service with the department. His retirement results from the Employee's Retirement Act making retirement compulsory at the age of 70 years.

During his career as an inspector, Mr. Poehlmann was a charter member and past-president of the Wisconsin Chapter, IAEI as well as a charter member of IAEI. For many years he served on the Executive Committee of the Chapter.



INFORMAL DISCUSSIONS flourished at the A.I.E.E. National Technical Meeting in Cleveland. Here are left to right: C. T. Britton, Holtzer Cabot Electric Co.; Fred Foulon, Douglas Aircraft Company; and E. S. McConnell, U. S. Rubber Company.

"Skilled" Lighting

standards maintained

in "WAR AID"

Fluorescent
Fixtures



Easily applied couplings firmly connect adjacent ends of units on Continuous Installations.

Wheeler "War-Aid" Fluorescent fixtures are constructed for use with 2 or 3 40-watt lamps, and 2 100-watt lamps. Units are available for Individual or Continuous Installations.

Fixtures have a sturdy metal-conserving wiring channel, non-metallic reflector with chip-proof, washable surfaces. Minimum overall efficiency of 80% for 48" 2 lamp units, 76% for 3 lamp units, and 74% for 60" 2 lamp units.

Units are supplied with loops for chain suspension and with knockout for con-

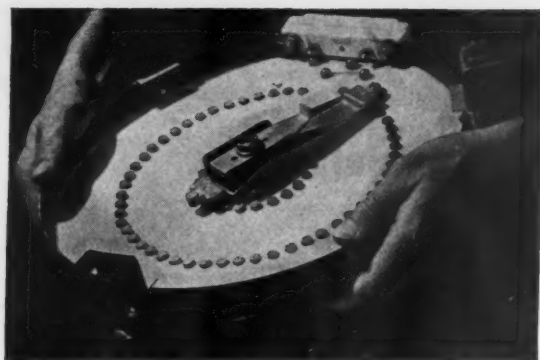
duit mounting. In addition, Wheeler "C-Clamp" Sliding Hangers are available which permit fixtures to be mounted on rods, conduit, close to ceiling, or by messenger cable.

Whether you require fluorescent or incandescent illumination, Wheeler can supply Skilled Lighting for precision production. Write for catalogs of both types. Wheeler Reflector Company, 275 Congress Street, Boston 10, Mass. . . New York. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881



IT'S SUBSTANTIAL



Pressed Steel Rheostats are made in 4" to 18", Ring types from 1½" to 4" inclusive.

Ward Leonard Pressed Steel Rheostats, properly installed and used, will outlast the machines they control. They are absolutely smooth in operation. They dissipate heat from both sides. Contacts are solid metal ground for perfect fit. These are but a few of their many advantages.

Bulletin 60 gives full particulars. Ask for a copy.



WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) devices since 1892.

WARD LEONARD ELECTRIC CO., 28 SOUTH STREET, MOUNT VERNON, NEW YORK

Test Insulation the Modern Way with a MODEL B-5 MEGOHMER

NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.



VARIOUS NEW MODELS
AND RANGES

HERMAN H. STICHT CO., INC.
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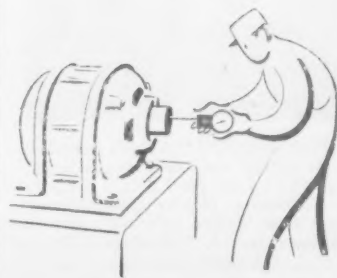
Signed

Dynamic Braking of Squirrel Cage Motor [FROM PAGE 37]

torque possible during deceleration is about the same as the average amount of accelerating torque when the motor is started across full line voltage, i. e., with the d.c. braking current about equal to the motor inrush current. The braking torque will stop any kind of inertia load in about the same time as the motor would require to accelerate the same load to full speed. This amount of braking, however, approaches the maximum practical limit, because that amount of direct current just about saturates the core and any further increase in current will only slightly reduce the stopping time. If the braking current is limited through a resistor to a value below the saturation point, any reduced braking torque can be obtained which will stop the motor in any predetermined time.

D.c. braking is capable of surprisingly accurate stopping provided, of course, that the inertia load is constant. Furthermore, once the d.c. is adjusted to provide the desired braking, it will remain constant indefinitely, there being no brake lining to wear and no fluid to disintegrate as in some braking mechanisms. It must be understood, however, that there is no holding action after the motor stops, because the d.c. must be removed in order to prevent the motor from overheating. D.c. dynamic braking is now being applied successfully to motors which are rated up to 50 hp. and larger.

In applications where direct current is not available or where line costs are excessive, the d.c. power may be obtained economically through the use of dry type rectifiers. Due to the fact that the braking power is used for such a short period of time, the rectifiers need be only a fraction of the size or cost that would be required for the same current if used continuously. Single phase power fed into a double wave rectifier is satisfactory for most applications.



Electrical Contracting, October 1943



"SURE!
We can do it
because we're using
KONDU"

Only with Kondu can you put in a conduit line before the fittings are delivered—or change boxes at any time, without disturbing conduit. *Every Kondu box is a union.*

Only with Kondu can you attach either Thin-Wall or Thick-wall conduit at any outlet, with either a Threadless or Threaded connection, as required.

And Kondu makes the hard jobs easy. It goes on bent conduit as easily as on straight. Can be installed close to corners or girders.

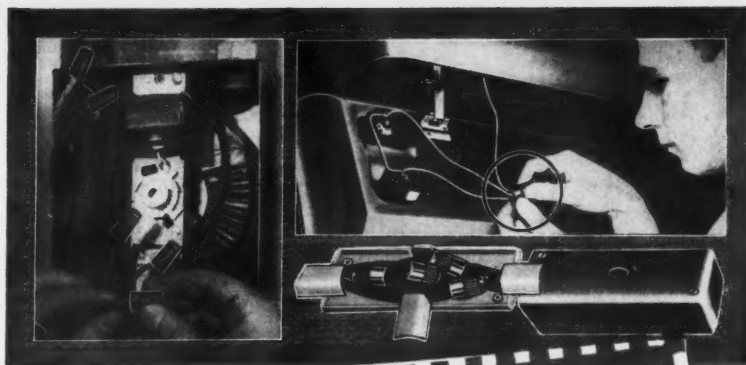
100% re-usable. Kondu fittings are practically unbreakable. Self-aligning and self-locking . . . permanently vibration-proof.

Write for the Kondu Catalog.

KONDU CORPORATION
Erie, Pa.



Electrical Contracting, October 1943



NO RESTRICTIONS
IDEAL ON
Solderless, Tapeless Wire Connectors

A N ALTERNATE and IMPROVEMENT for Solder-and-Tape Wire Joints. IDEAL "Wire-Nuts" (solderless-tapeless wire connectors) contain no copper or copper alloys—no tin or rubber as used with Solder-and-Tape Joints. Because "Wire-Nuts" do not require these critical materials, they are *Immediately Available.* Easy to use; strip wires, screw on, that's all!

BETTER ELECTRICALLY ★ **STRONGER MECHANICALLY**
 "Wire-Nuts" powerful grip on wires prevents shorts, grounds and corrosion—and they withstand several times greater pull than the best solder joint.

FULLY APPROVED. Listed by Underwriters' Laboratories, Inc. Sizes for connecting all combinations from two No. 18 to three No. 10 solid or stranded wires.

★ ★

★ **Plant Wiring Simplified** ★

★ IDEAL "Wire-Nuts" make all plant wiring jobs easier-
 ★ safer-faster. Use "Wire-Nuts" for adding new circuits, making
 ★ temporary installations and re-locating machinery. ★

★
 ★ *If your Electrical Jobber hasn't a supply, kindly*
 ★ *write or wire, mentioning Jobber's name.*

★ **PROMPT DELIVERY** ★

IDEAL Sycamore

★ IDEAL COMMUTATOR DRESSER CO ★
 1041 Park Avenue Sycamore, Illinois

Sales Offices in all Principal Cities.

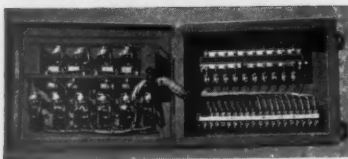
When
"KNOW-HOW"
is important

let
MILLER
do it!

The South's largest general electrical contractor offers you the experience gained from millions of dollars worth of successfully completed contracts for Army, Navy and civilian projects of all kinds including structural work and public utilities distribution systems.

Full equipment and engineering staff available to service any contract, regardless of size.

**Miller Electric
Company**
556 Riverside Ave.
Jacksonville, Florida



**Marine Electrical
Specialties**

All types of electrical specialties, boxes, cabinets, control panels, duct-work, etc., manufactured by an organization accustomed to meeting exacting Army and Navy specifications. Full engineering personnel and equipment for manufacture of special electrical items in addition to all standard articles.

Write for information.

**Jacksonville Metal
Manufacturing
Company**
JACKSONVILLE, FLORIDA

Emergency Wiring For Ordnance

[FROM PAGE 35]

cable must be installed on the outer edge of the support, it is protected by half-round wood molding.

Each motor in the building is individually fed by a four-wire, non-metallic sheathed cable circuit with the fourth conductor serving as the equipment ground. There is no grouping of several motors on a single, heavy, branch circuit. Motor connections are made through explosion-proof flexible conduit, sealing fittings and E.M.T. risers for mechanical protection. The circuit cable terminates at the top of the conduit riser in an explosion-proof fitting equipped with special rubber grommets to make a dust-tight connection.

Lighting circuits are also run in non-metallic sheathed cable. The number of units on a single circuit depends upon the conductor size and safe capacity of the cable. The type of lighting unit used in the shell loading lines depends upon the particular area in which it is mounted. They range from standard incandescent units in non-hazardous areas to explosion-proof units in the few areas where explosive gases and fumes may be present (i.e.—in the shell-spraying booths and areas). Since explosive dust is the hazardous condition in most areas, vapor-proof and dust-tight units are prevalent. Lighting fixtures are mounted to specially adapted explosion-proof and dust-tight outlets whose hubs are fitted with rubber grommets to receive the cable and special gripping rings to accommodate the E.M.T. fixture stems. Lighting switch outlets at standard operating levels are equipped with explosion-proof sealing fittings that have ordinary cable clamps to grip the cables.

All Connections Sealed

All connections in the entire electrical systems are carefully sealed in accordance with the prescribed practice for hazardous locations. All non-metallic sheathed circuits originate in the outdoor distribution centers. They leave the back of the Transite enclosure through a special entrance box mounted to the inside of the building wall, about six to eight feet above floor level, and nipped to the back of the outdoor enclosure. This rectangular box is made of 20 gauge black iron with all seams brazed with Silfoss to make them watertight. The entire box is then Bonderized to protect it against rust and corrosion. The cables pass through the

(Continued on page 146)

TIME SWITCHES

TRIPLE POLE
DOUBLE POLE
SINGLE POLE

All three types can be furnished with capacities ranging from 20 TO 200 AMPERES PER POLE, listing from \$16.50 up. Ten ampere Time Switches from \$3.95 up.

PROCESS TIMERS

INTERVAL TIMERS, or PROCESS TIMERS, are furnished in two types. One is reset by hand (manual); other resets itself, automatically. Both types can be provided for practically any cycle of time, fully adjustable from zero to maximum period. SYNCHRONOUS, SELF-STARTING MOTORS.

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Used extensively for starting and stopping industrial work; school class periods; for municipal time signals, etc. Up to six signal periods, permanently set at factory with Sunday & Holiday Cutout and Manual Control, at a list price of only \$35.

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Safe-T-Glow

HIGH TENSION
DETECTOR



Cut-Out Shows Inside View

SAFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages... prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts.
Model B for circuits from 35,000 to 220,000 volts.

Model A 3-ft. handle
Model B 6-ft. added extension

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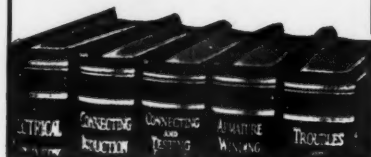
Tests Everything Electrical
from 100 to 550 Volts



Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List \$1.50 (Priority A-7) Purchase thru regular electrical dealers.

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electrical maintenance
and repair work
covered in this library**



**5 volumes of practical
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Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with hand-book information covering these methods.

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These books show you how to

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- know just what is wrong with an electrical machine and take charge of installation and maintenance work;
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- handle every sort of wiring job;
- show competence whether it be in the use of a Stillson wrench or a Wheatstone bridge.

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Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a book giving helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery trouble, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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Electrical Contracting, October 1943

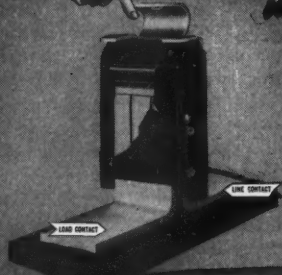
WHY

Vacu-Break

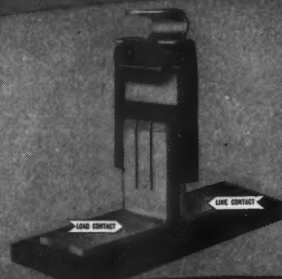
SAFETY SWITCHES?



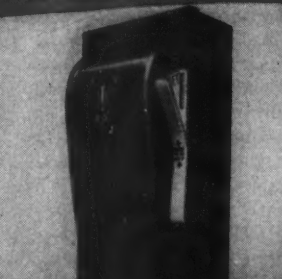
Here's Why —



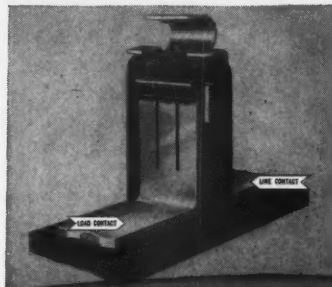
PARTIAL VACUUM
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CONTACTS MAKE AND BREAK
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PUSH-TYPE, FRONT OPERATED
rocker handles enhance the
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switch cabinets.



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BullDog's Clampmatic Vacu-Break design combines in a simple construction the two features most essential to flawless safety switch performance — *clamp-tight contacts* and *easy operation*.

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Switchboards, Circuit Master Circuit Breakers
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For a bright future BUY MORE WAR BONDS



...there's an easier way to end your motor problems ask Westinghouse!

Maybe the one best motor for your job has to be designed... maybe modification or selection of an existing type will do the trick. Either way, there's no substitute for "know-how" in designing, modifying or selecting it. Westinghouse puts 57 years of motor and control experience at your disposal to get the right answer sooner. For engineering aid, phone or write your nearest Westinghouse office. J-21288

Proof?
see page 99



Emergency Wiring For Ordnance

[FROM PAGE 144]

nipple, then fan out from this topless box. After the cables are in, the nipple is carefully packed and the entire entrance box filled with sealing compound, similar to the type used in conventional sealing fittings.

Whenever the cables terminate in a switch outlet or box, where there is danger of sparking, they first pass through a conventional sealing fitting. In junction boxes or fixture fittings, where only connections are housed, the cable enters the outlet through hubs equipped with dust-tight grommets.

Since there is practically no steel in the building construction, electrical and other equipment is carefully grounded to a static ground network embedded beneath the floors. This, in turn, is tied in with the ground network for lightning protection. Static grounding is accomplished by using a special asphalt flooring compound that has enough graphite in its composition to make it conductive. Ground wire leads projecting through the concrete floor base make contact with this flooring at numerous points. Some five tons of $\frac{1}{8}$ -inch copper sheeting originally specified was saved by installing this particular type of finished floor.

All portable motors are equipped with four-conductor cable, the fourth wire being used as a ground conductor. One application of this scheme is found in the vacuum cleaner units used to clean the loading lines each day. These explosion-proof motors are equipped with long four-conductor extension cords which are plugged into four-prong, weatherproof outlets mounted on the outer walls of the buildings at specified locations.

All lighting and switch outlets are grounded to the neutral conductor of the lighting system, making a continuous ground from one outlet to the other.

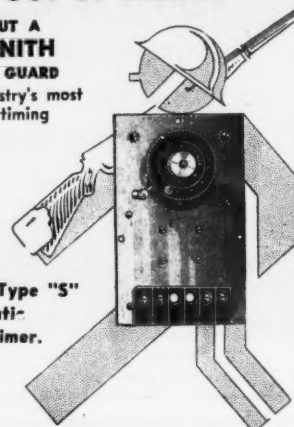
A strict maintenance program covering regular inspection is in operation at the plant. Only members of the electrical maintenance department have access to the distribution centers. Non-tamperable plug fuses of 15 ampere rating are used on the lighting branch circuits. Motor loads are protected by circuit breakers. A carefully engineered system assures no overloaded circuits. Tapping on existing branch circuits for any additional loads is forbidden. When additional lighting or power loads are installed, new and separate branch circuits are added to the system. Although the system was closely designed to

(Continued on page 148)

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services



**Zenith Type "S"
Automatic
Reset Timer.**

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Easily adjusted visible time-setting dial. Remote control permits operation of timer directly from controlled machine. Motor drive. Simple to preset. Automatically reset. Types to meet all requirements for circuit closing, time delay, etc. Many circuit combinations.

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Illustrates and describes latest in control equipment: Magnetic Contactors, Automatic Transfer Switches, Time Switches, all types of Timers, etc. Control equipment for special jobs.

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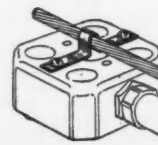
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• The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They have considerable material and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

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"Messenger Hanger" for Conduit and Cable Strong, made of Cadmium Plated Steel or Everdur. Top loop of hanger grips messenger cable to permit conduit to be put in place without falling off.



"Messenger Strap" for Outlet Boxes Of Cadmium Plated Steel or Everdur. For messenger cable installation to be used with Minerallac "Messenger Hanger." Fits all standard outlet boxes and $\frac{3}{4}$ " messenger cable.

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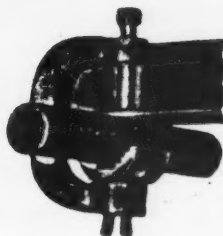
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No. 110 Non-Adjustable
Watertight Floor Box
Iron box body, 3½ in. round
brass cover plate. Shown with
No. 208 Receptacle and No.
207 Bell Nozzle. Overall
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No. 470 "Bull Dog"
Pipe or Conduit Hanger
A grand clamp for hanging
pipe or conduit to steel
beams. Will hang pipe ½",
¾" and 1" to ¾" beam. Will
accommodate copper wire
Nos. 8 to 4.



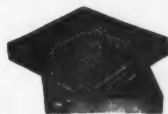
No. 100 Non-Adjustable
Watertight Floor Box
with No. 206 Nozzle
Used as telephone outlet or
junction box. Iron box body,
3½ in. round brass cover
plate. With or without stem
nozzle.

Unsurpassed for War Emergency and Civilian Jobs

On all installations where time is important Latrobe Products lead
the field. Just as they do in point of dependable service. Modern
in design, quickly installed,
trouble-free for life.



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Shows cleat at-
tached to No. 403
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Keystone Fish Wire
High grade steel wire correctly tem-
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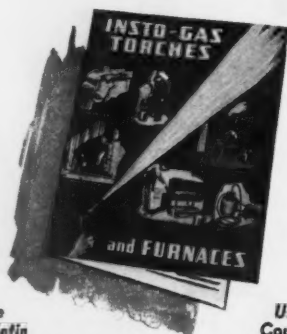
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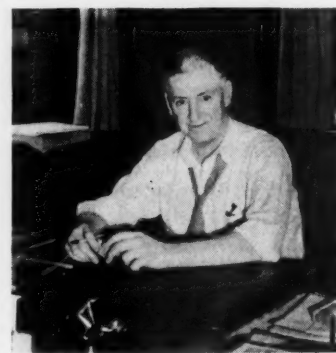
Emergency Wiring For Ordnance

[FROM PAGE 146]

conserve copper, the engineers' calculations were based on a minimum of voltage drop. Since the majority of the system load is lighting, the overall power factor averages 93 percent. These conditions will permit about a ten percent increase in load on the feeders, with a slight sacrifice of voltage drop.

A mandatory program of good house-keeping lessens the danger of overheated cables. Every day the loading lines are vacuum cleaned to remove any powder dust that may have settled on the floors, walls and ceilings. This includes all equipment and electrical circuits which receive a daily dusting. There is always ample ventilation around the circuits and, in some instances, the cables are painted to provide a smooth outer surface to which the powder dust will not cling so readily.

This wiring system should not be construed as a permanent installation that can be given a broad application in industry. It is definitely an emergency design conceived for this specific type of plant. It has been in continuous operation now for more than eight months and not the slightest bit of electrical trouble has been experienced; nor is any anticipated. It is doing a job in this plant. Through its use the contractors hurdled materials difficulties and got the plant in operation in the shortest possible time.



GEO. W. PHELPS manager for James Wilkinson and Company, Boston electrical contractors, organized a Blitz crew of five hand picked men and a foreman when war contracts came pouring in on top of their regular business. Phelps jumped this crew from job to job, throwing its weight wherever needed to speed completion. This system enabled them to "come out on top" every time in meeting completion dates so that all of the smaller crews could be consolidated into the large crews necessary to handle the bigger war contracts being let. One of their larger recent completions was the major contract at the new Bethlehem-Hingham shipyard at Hingham, Mass.

Electrical Contracting, October 1943

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Here's a sturdy \$12.00 device with which you can instantly locate the exact position and outline of hidden metal outlet boxes, steel conduit and armored cable. Whether "lost" under plaster, wood, linoleum, thin tile or concrete, the DETECTOR finds them . . . saves costly wall demolition. DETECTOR emits a high frequency violet spark (when box is detected) from tip of removable steel "MARKER" electrode.

* Residential, Commercial and Industrial Contractors all need several OUTLET DETECTORS. * Chief Electricians of Institutions and office buildings need a DETECTOR in making wiring changes.

* Price is only \$12.00, postage prepaid. Includes DETECTOR unit with 6 ft. of rubber cord. Safety design employs 12" knurled bakelite case, with spark volume control knob. Operates on 110 A.C. only.

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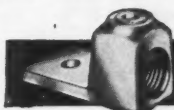
330 West 42nd Street
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"These are **BUSY** days!"

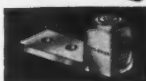


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You can buy Tee Connectors, Grounding Clamps, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Service Connectors, Bus Supports, Terminals . . . practically every good type, in the COMPLETE line.

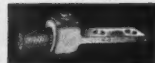


JUST FOR EXAMPLE—here are some of the standard Penn-Union Vite terminal lugs:



2-bolt flange

45° flange



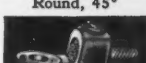
Side flange

Center tongue



Round, 45°

Round, 90°



Round, offset

Round, center

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1600 pages of

practical data, helpful pointers, explanatory illustrations and diagrams, useful rules, recommendations, and short cuts, and much descriptive information on modern electrical practice. 527½, 1177 illustrations, price only

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Hundreds of facts condensed and classified for quick, easy use—Use this Handbook to check your methods for quick answers to troublesome problems, as a dependable reference and study guide of electrical fundamentals, equipment, and materials, and their application.

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Address
City and State
Position
Company EC 10-43

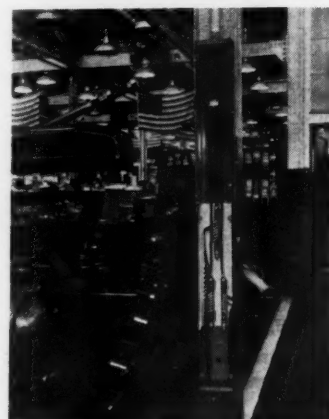
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such materials as:

- most complete data and information on all commonly employed electric wires and cables ever assembled in one volume, to help in selection of proper type for any installation, methods of handling, splicing, etc.
- simple instructions for calculating load on circuits, and for selecting proper wire size to meet voltage drop and current carrying capacity conditions.
- entirely new division to aid in selection and specification of switching, protective, capacitor, and wiring-device equipment, estimation of space requirements for switchboards, care and operation of batteries, etc.
- practical data on operation, care, installation, and selection of motors and control equipment, including information on planning of motor circuits and drives.
- helps on installation, care, and proper loading of transformers
- practical information on construction methods and materials in outside distribution
- details of all types of interior wiring; developments in light sources and luminaire equipment; etc.
- new section of 84 handy wiring tables, conveniently arranged

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EXAMINATION**

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were limited so that they could be mounted in the H-beam structural columns without protruding. Feeders drop down the columns in conduit from the 550 volt overhead bus duct. These machine feed panels are placed at each column throughout the machining areas, so that as machinery is shifted around, only a short trenching in the wood block floor is required to feed the machine at the new location. All drop circuits have been removed, permitting the



SIX HUNDRED VOLT PANEL designed to feed a total of eight 3 phase circuits, and limited in dimensions so that it may be mounted flush in the eight-inch H-beam structural columns. The purpose is to give trench feed thereby eliminating drop circuits which interfered with overhead crane operation. Flexibility was also achieved since machinery in this area is being constantly re-located to suit production requirements.

use of transverse overhead cranes which have speeded production. The only interruption to other machinery is the few seconds required to disconnect or reconnect the lugs from the machine being moved.

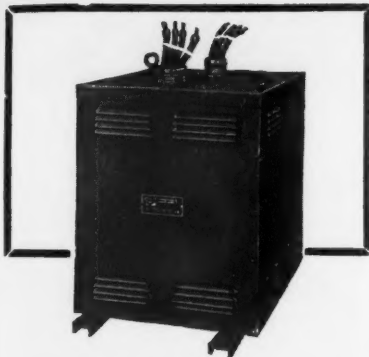
The result has been very satisfactory not only from an operational standpoint but also from the standpoint of a better looking shop.

OUTDOOR DUCT FEEDS TOOL PLANT

—WIRING

Heavy secondary circuits feeding a large midwest tool plant had to be installed on the outside of the building wall to reach the main switchboard room. A narrow areaway between the plant and an adjacent building was almost totally obstructed by a circular steel smokestack.

The size of the circuits, each of 2000 ampere capacity, would have required multiple conductors in several tiers of conduits, if the conventional conduit and cable method was employed. Elab-



AIR-COOLED TRANSFORMERS

Up To 50 KVA
Up To 2400 Volts

Acme standard air-cooled transformers are heavy-duty design, built for economical, efficient, continuous performance. Buy quality, specify Acme air-cooled transformers in ratings from 3 KVA to 50 KVA, 3 phase 60 cycle, 240/480; 600; or 2400 volt primary; 1½ to 50 KVA, 60 cycle single phase, 240/480; 600; 2400/4160 volt primary. Write for Bulletin 160.

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Acme Electric
TRANSFORMERS

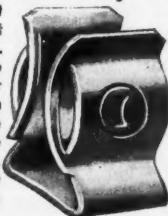
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Electrical Construction — Maintenance — Repairs

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PARTS

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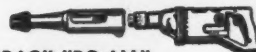
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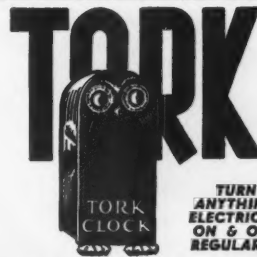


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ANYTHING
ELECTRICAL
ON & OFF
REGULARLY

The TORK CLOCK CO., Inc.
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Complete Power Generating Plant!!
500 KVA AC—including Boiler, all equipment in perfect operating condition.

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MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

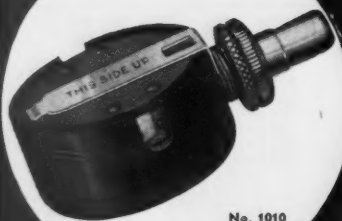
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PRECISION
Individual Control
SWITCHES
*"Built like a
Watch"*



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5 Amp., 125 Volt



No. 1010

10 Amp., 125 Volt

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orate angle iron racks to support the numerous conduits in the restricted space would have presented another problem. Adding to the complications were at least seven right angle bends and a couple of 45 degree offsets in each run, making cable pulling operations practically impossible.

The entire feeder problem was solved by the use of three runs of weather-proof L-V-D (low voltage drop) Buss-Wa installed by the Bertke Electric Company, Cincinnati, Ohio. Each



TRIPLE TIER of 2000 ampere weather-proof bus duct leaves a transformer station to carry secondary power to a large midwest tool plant.



DUCTS SKIRT smokestack in narrow areaway then drop down building wall to enter switchboard room. This is opposite end of runs shown in photo above.

2000 ampere run originates at an outdoor transformer substation at one end of the plant, rises vertically to clear areaway obstructions, follows the wall of the building skirting around a steel smokestack, then drops vertically to enter the indoor switchboard room of the plant.

The problem of supporting these heavy duct runs, which of necessity had to run along window areas, was simplified by the use of double hook type hangers which clamped to a moulding provided on two sides of the duct. These hangers were bolted to vertical double angle iron strips.



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MOTOR-STARTING Capacitor

● Handy Aerovox listings of both the exact-duplicate and the so-called universal types, facilitate the selection of the **RIGHT** capacitor for any standard capacitor-start refrigerator motor.

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A large supply of all standard types are carried in stock, thus assuring you prompt service at all times. Write for catalog sheet 1-2 for full details or see your Electrical Wholesaler.



**NORTH AMERICAN
ELECTRIC LAMP CO.**

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BADGER Synchronous ELECTRIC TIME SWITCHES



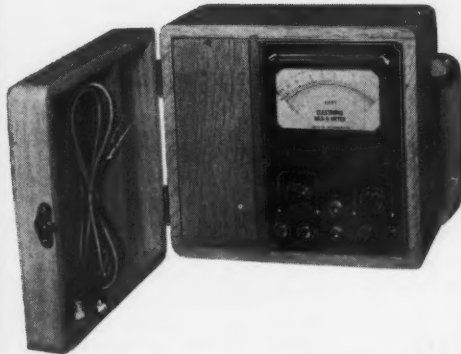
CONTRACTORS LIKE THEM BECAUSE:
they are dependable and easy to install
USERS LIKE THEM BECAUSE:
of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

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THE MODEL 610-B

MEG-O-METER



A New Battery Operated INSULATION TESTER!!

Instantly measures the exact leakage of all insulation up to—

200 MEGOHMS

At a test potential of
500 VOLTS D. C.

Supplied by a built-in battery and vibrator power supply

SPECIFICATIONS:

• **NO HAND CRANKING**—The 500 VOLT POTENTIAL is made instantly available by simply throwing a front panel toggle switch.

• **DIRECT READING**—All calibrations printed in large, easy-to-read type enabling exact determination of leakages from 0 to 200 Megohms. In addition, the Megohm scale is also sub-divided into BAD (0 to 1 Megohm) DOUBTFUL (1 to 3 Megohms) GOOD (3 to 200 Megohms) sections. The BAD Section which indicates

the danger point is printed in red.

• **3 RANGES:** 0 - 20,000 Ohms, 0 - 2 Megohms and 0 - 200 Megohms.

• The instrument is housed in a heavy-duty Oak portable cabinet.

• Panel is of solid bakelite engraved by the new "cut-in" process which eliminates possibility of letters being scratched off.

• Meter movement—a 4 1/4" 0 to 200 Micro-ampere sensitive meter guarantees extremely accurate readings on all ranges.

Model 610-B comes housed in a beautiful, hand-rubbed Oak cabinet complete with cover, self-contained batteries, test leads and instructions. Size 9 1/2" x 8 1/2" x 6". Shipping weight 16 pounds. Price... **\$62.50**

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SIMPLEX WIRES AND CABLES

After the War

YOU may have wondered how insulated wires and cables that you will buy after the war will differ from those that have served you so well. No one knows all the answers but we can make some predictions about Simplex wires and cables, based on past experience and present developments.

SINCE 1885 Simplex has devoted all its energies to providing insulated wires and cables needed by the rapidly expanding electrical industry. Our aim has been not only to meet requirements by keeping abreast of industry development but, if possible, to anticipate its needs. Simplex in this has earned a reputation as a pioneer in cable engineering.

The adjustments made necessary by military needs and the unusual demands of war-time industry always have stimulated research and led to better products for commercial use later. The present emergency is no

exception. Cable developments now taking place cannot be discussed but definite and important changes are being made which can be adapted to commercial uses when victory has been achieved.

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Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

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a Socket?*

To Avoid Troubles

hundreds of heavy industrials
and shipyards are using our



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63310

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SOCKET**

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New York City

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★ These companies have included Briefelegs, containing additional buying information on their products, in the 1943 edition of the Electrical Buyers' Reference.



**SURE, I'M IN THE MARKET
FOR ELECTRICAL EQUIPMENT
NOW THAT I CAN BUY WIRE!**

● It has been a long time since farmers have been able to do much in the way of increasing or even maintaining their electrical equipment. Back in the days of extensive rural electrification, many of them got as far as "tapping in" but didn't complete the job of modernizing their facilities, simply because they didn't have the money.

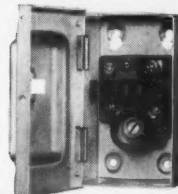
Today they have the money and under the provisions of WPB orders M-330, U-1-C and PR19, they are given priority assistance in purchasing electrical equipment.

Electrical contractors will find a ready farm market for a variety of devices and the installation work which goes with them. The farmer, the Department of Agriculture county agent, and the contractor make a good trio in getting much needed rural electrical improvements under way.

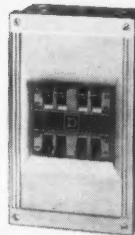


Class 9013 Pressure Switch for deep well pumps. Heavy duty, 2 H. P., 110 volts.

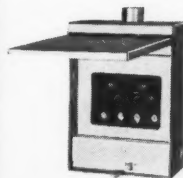
Multi-breakers. 15-50 ampere circuits. A low-priced, efficient circuit breaker in standard or raintight boxes.



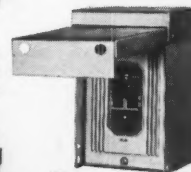
Blue Label Switches. Small and compact. For 30 and 60 ampere, 230 Volts A. C. applications.



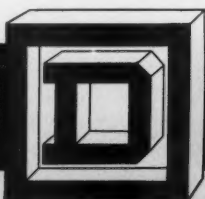
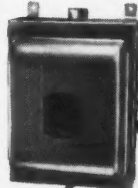
Type C and D Safety Switches in standard or raintight enclosures.



Entrance switches with range and lighting circuits. Pull-out mains. Standard or raintight boxes.



MO Multi-breakers. 15 to 25 amperes, single or double pole. Raintight or standard enclosures.



ELECTRICAL EQUIPMENT

KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT

MILWAUKEE

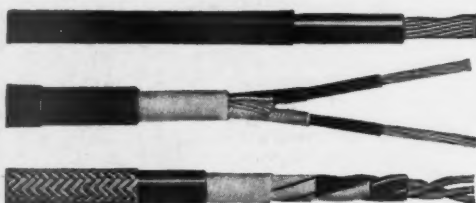
LOS ANGELES



Small Diameter FLAMENOL BUILDING WIRE

TYPE SN

G-E SMALL-BOAT CABLES



G-E Small-boat cables are designed especially for use on the small boats being built for the U.S. Government's boat building program. They are available with one, two, three or four stranded copper conductors and are well designed and carefully made. The conductors have Flamenol* insulation. Cotton fillers are cabled with the conductors under a Flamenol* sheath. This sheath is resistant to oil, gas, acid, sunlight, salt water, etc. Over-all is a moisture-resisting and flame-retarding cotton braid. (Galvanized steel braid with aluminum paint on armored cables.) G-E Small-boat Starter Cables are also available.

*Reg. U.S. Pat. Off.

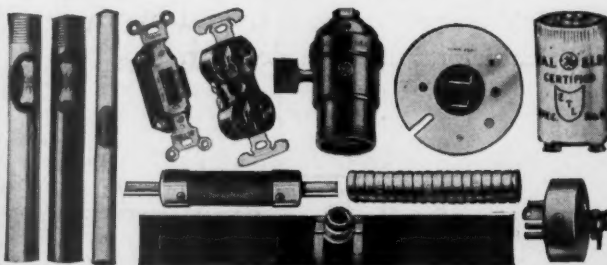
Again thermo-plastic small diameter Flamenol Building Wire is available for war-purpose wiring. The available supply of resins has improved. They are permitted for electrical conductor insulation wherever copper is allocated.

Use this easy-to-handle, dependable wire for maintenance jobs, for rewiring and for new wiring. Its small diameter permits more wires to be used in conduits for both rewiring and new wiring. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to moisture, oil, acid, etc. It is available in sizes 14 and larger which enables it to be used for feeders as well as branch circuits.

FOR FURTHER INFORMATION on Flamenol Building Wire, G-E Small-boat Cables, conduits or wiring devices, see your G-E Merchandise Distributor or write to Section CDW-1031- 8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

G-E WIRING DEVICES AND CONDUITS

General Electric offers five conduits and hundreds of wiring devices for war jobs including: G-E White zinc covered conduit, G-E Black enamelled conduit, EMT, flexible metal conduit; and switches, lampholders, outlets, fuses, etc.



GENERAL  ELECTRIC